MODEL 1120
AUDIO ANALYZER
INSTRUCTION MANUAL

BOONTON
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SAFETY SUMMARY

The following general safety precautions must be observed during all phases of operation and maintenance of this instrument. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of the instruments. Boonton Electonics assumes no liability for the customer's failure to comply with tbese requirements.

THE INSTRUMENT MUST BE GROUNDED.
To minimize shock hazard the instrument chassis and cabinet must be connected to an electrical ground. The instrument is equipped with a three conductor, three prong a.c. power cable. The power cable must either be plugged into an approved tbree-contact electrical outlet or used with a three-contact to a two-contact adapter with the (green) grounding wire firmly connected to an electrical ground at the power outlet.

DO NOT OPERATE THE INSTRUMENT IN AN EXPLOSIVE ATMOSPHERE.
Do not operate the instrument in the presence of flammable gases or fumes.

KEEP AWAY FROM LIVE CIRCUITS.
Operating personnel must not remove instrument covers. Component replacement and internal adjustments must be made by qualified maintenance personnel. Do not replace components with the power cable connected. Under certain conditions dangerous voltages may exist even though the power cable was removed; therefore, always disconnect power and discharge circuits before touching them.

DO NOT SERVICE OR ADJUST ALONE.
Do not attempt internal service or adjustment unless another person, capable of rendering first aid and resuscitation, is present.

DO NOT SUBSTITUTE PARTS OR MODIFY INSTRUMENT.
Do not install substitute parts or perform any unauthorized modification of the instrument. Return the instrument to Boonton Electronics for repair to ensure that the safety features are maintained.

SAFETY SYMBOLS.

This safety requirement symbol (located on the rear panel) has been adopted by the International Electrotechnical Commission. Document 66 (Central Office) 3, Paragraph 5.3, which directs that an instrument be so labeled if, for the correct use of the instrument, it is necessary to refer to the instruction manual. In this case it is recommended that reference be made to the instruction manual when connecting the instrument to the proper power source. Verify that the correct fuse is installed for the power available, and that the switcb on the rear panel is set to the applicable operating voltage.

CAUTION

The CAUTION sign denotes a hazard. It calls attention to an operation procedure, practice, or the like, which, if not correctly performed or adhered to, could result in damage to or destruction of part or all of the equipment. Do not proceed beyond a CAUTION sign until the indicated conditions are fully understood and met.

WARNING

The WARNING sign denotes a hazard. It calls attention to an operation procedure, practice, or the like, which, if not correctly performed or adhered to, could result in injury or loss of life. Do not proceed beyond a WARNING sign until the indicated conditions are fully understood and met.

Indicates dangerous voltages.

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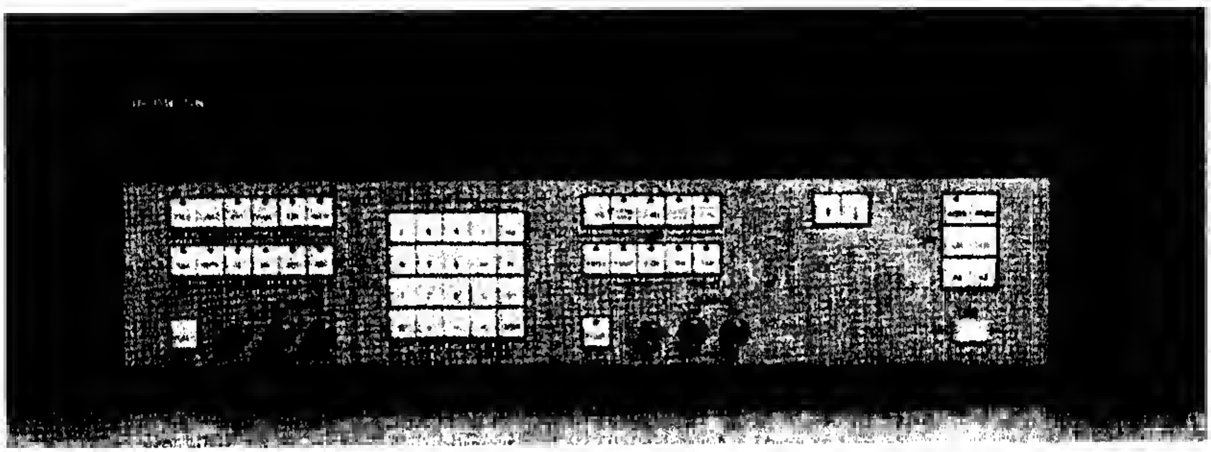

Figure 1-1. Model 1120 Audio Analyzer.

SECTION I
GENERAL INFORMATION

1-1. INTRODUCTION.

1-2. This instruction manual provides installation and operating instructions, theory of operation, maintenance instructions and parts lists for the Model 1120 Audio Analyzer.

1-3. DESCRIPTION.

1-4. The Model 1120 is a versatile, precision, solid-state instrument with features and performance characteristics especially suitable for laboratory and industrial applications. Human engineering considerations have been emphasized in both the mechanical and electrical design of the Model 1120. The result is an audio analyzer that is easy and convenient to use, despite its flexibility. Among the outstanding features are:

a. Precision Audio Source. High resolution and accuracy of the audio source make the 1120 suitable for precision testing applications while the ultra low distortion and noise satisfies the demands of digital audio applications.

b. Versatile Audio Analyzer. Advanced measurement techniques enable the Model 1120 to provide fast, accurate measurements. Measurement modes include Frequency, AC or DC level, Distortion, SINAD, Signal-to-Noise and full Ratiometric capability.

c. Separate Displays of All Major Functions. The Model 1120 has 3 separate display windows to present simultaneously source settings, analyzer measurements, and program number or bus address information. Continuous display of IEEE-488 bus status is also presented.

d. Full Range of Filter Selections. The Model 1120 provides a wide range of filter selections and weighting characteristics for industry-standard audio measurements.

e. Automatic Sweep Functions. The audio source can be configured to sweep frequency or amplitude ranges with X axis and pen control while analyzer measurements provide Y axis data. Plotter outputs are provided on the rear panel.

f. Balanced Input And Output. The Model 1120 has a differential/balanced Analyzer input for testing bridged amplifiers and power supplies. The balanced/floating Source output aids in eliminating ground loops for broadcast and professional audio applications.

g. Instrument Setup Memory.

Up to 99 complete front panel setups can be stored in non-volatile memory for future recall. Contents of each setup include all data required to configure both the Source and the Analyzer to a previous operating mode. The last valid instrument setup before power interruption is also saved automatically and restored when power is resumed.

h. IEEE-488 Interface Bus. All instrument functions are programmable except bus address. Annunciators to the left of the BUS/PRGM display window show the status of bus activity. Bus operation is completely interactive with full talk and listen capabilities including return of values in the talk mode. Memory contents can also be stored or recalled via the bus. The 1120 is designed to interface easily with controllers currently in use. A versatile free-form number entry system is used so that the 1120 will accept any conceivable valid number string. Formatting is therefore optional in the control program, which aids in getting an application up and running. Triggering may be performed in immediate or wait modes. There are six talk modes which can be addressed in either the remote or local state. The 1120 also provides a choice of several end-of-string terminators. Service-request (SRQ) can be asserted on errors or using the front panel SRQ key and the LCL key will force return to local control when using the bus as long as a lockout message has not been sent.

1-5. ACCESSORIES.

1-6. The following accessories are supplied with the instrument:

a. AC power cord
b. Spare input/output fuses

1-7. The following accessories are available:

a. 950044 Rack mounting hardware
b. 950043 Chassis slide kit
c. 95401801a Single binding post to BNC (M) adapter
d. 95401901A BNC (F) to phono plug
e. 95402001A Phono jack to BNC (M)
f. 95402104A Two conductor shielded balanced line, 36 inches
g. 95402201A XLR connector to three banana plugs

1-8. OPTIONS.

1-9. The following options are available:

-01 Rear panel input and output connectors
-11 400 Hz high-pass filter
-12 CCITT weighting filter
-13 CCIR weighting filter
-14 CCIR/ARM weighting filter
-15 A weighting filter
-16 B weighting filter
-17 C weighting filter
-18 Audio band-pass filter
-19 C-MESSAGE filter

1-11. SPECIFICATIONS.

1-12. Performance specifications for the Model 1120 Audio Analyzer are listed in Table 1-1.

TABLE 1-1. PERFORMANCE SPECIFICATIONS.

ANALYZER SPECIFICATIONS

Frequency Measurement
Range: 5 Hz to 200 kHz
Sensitivity: 3 mV
Accuracy: Timebase accuracy +- 1 count
Resolution:
0.001 Hz; 5.000 to 199.999 Hz
0.01 Hz; 200.00 to 1999.99 Hz
0.1 Hz; 2.0000 to 19.9999 kHz
1.0 Hz; 20.000 to 199.999 kHz

Timebase
Type: 10 MHz TCXO
Accuracy: +- 1 ppm/yr

AC Level Measurement
Range: (full scale)
300.0 V, 30.00 V, 3.000 V,
300.0 mV, 30.00 mV, 3.000 mV
Overrange: 20 % except on 300 V range
Accuracy:
+- 1 %; 50 Hz to 50 kHz, 1 mV to 300 V
+- 2 %; 20 Hz to 100 kHz, 1 mV to 300 V
+- 3 %; 10 Hz to 100 kHz, 1 mV to 300 V
Flatness: 1 mV to 300 V
+- 0.5 %; 50 Hz to 50 kHz
+- 1.0 %; 20 Hz to 100 kHz
+- 2.0 %; 10 Hz to 100 kHz

DC Level Measurement
Range: (full scale)
300.0 V, 30.00 V, 3.000 V
Overrange: 20 % except on 300 V range
Accuracy: +- 0.3 % + 10 counts

TABLE 1-1. CONTINUED.

Common Mode Rejection Ratio
CMRR:
> 70 dB; 20 Hz to 1 kHz
> 45 dB; 1 KHz to 20 kHz
Limits:
< 4.25 V pk; 3.000 V range
< 42.5 V pk; 30.00 V range
< 425 V pk; 300.0 V range

Analyzer Input
Type: Balanced (full differential)
Impedance: 100 k ohms +- 1 %, < 300 pF, each side to ground in all measurement modes
Protection: Excessive common mode levels are hardware limited on all input ranges and fuse protection is employed against peak levels exceeding 425 volts

Distortion Measurement
Fundamental Frequency Range:
10 Hz to 100 kHz usable to 140 kHz
Resolution:
0.0001 %; < 1.1000 %
0.001 %; < 11.000 %
0.01 %; < 100.00 %
Display Range:
0.0001 to 100.00 % (-120.00 to 0.00 dB)
Accuracy:
+- 1 dB; 20 Hz to 20 kHz
+- 2 dB; 10 Hz to 100 kHz
Input Voltage Range: 10 mV to 300 V
Distortion Measurement Range:
0.01 % (-80 dB) or 10 uV; 10 Hz to 20 kHz, 80 kHz BW
0.02 % (-74 dB) or 20 uV; 20 to 50 kHz, 220 kHz BW
0.056 % (-65 dB) or 50 uV; 50 to 100 kHz, 500 kHz BW

SINAD Measurement
Fundamental Frequency Range:
10 Hz to 100 kHz usable to 140 kHz tuned to source frequency setting
Display Range:
-120.00 to 0.00 dB
Accuracy:
+- 1 dB; 20 Hz to 20 kHz
+- 2 dB; 10 Hz to 100 kHz
Input Voltage Range: 10 mV to 300 V
SINAD Measurement Range:
same as for distortion measurement

TABLE 1-1. CONTINUED.

Signal-to-Noise Measurement
Frequency Range: 10 Hz to 100 kHz usable to 140 kHz
Display Range: 0.00 to 120.00 dB
Accuracy: +- 1 dB
Input Voltage Range: 30 mV to 300 V
Residual Noise: (the greater of)
80 dB or 20 uV; 80 kHz BW
80 dB or 30 uV; 220 kHz BW
80 dB or 35 uV; 500 kHz BW

Standard Audio Filters
30 kHz Low-pass Filter Accuracy: 30 kHz +- 2 kHz
Rolloff: Third-order Butterworth, 60 dB/decade

80 kHz Low-pass Filter Accuracy: 80 kHz +- 4 kHz
Rolloff: Third-order Butterworth, 60 dB/decade

220 kHz Low-pass Filter Accuracy: 220 kHz +- 20 kHz
Rolloff: Third-order Butterworth, 60 dB/decade

Optional Audio Filters
400 Hz High-pass filter Accuracy: 400 Hz +- 40 Hz
Rolloff: Seventh-order Butterworth, 140 dB/decade

CCITT, C-MESSAGE Band-pass Filter Accuracy:
+- 0.2 dB; 800 Hz CCITT, 1000 Hz C-MESSAGE
+- 1.0 dB; 300 to 3000 Hz
+- 2.0 dB; 50 to 300 Hz, 3.0 to 3.5 kHz
+- 3.0 dB; 3.5 to 5 kHz

CCIR, CCIR/ARM Band-pass Filter Accuracy:
+- 0.2 dB; 6.3 to 7.1 kHz
+- 0.4 dB; 7.1 to 10 kHz
+- 0.5 dB; 200 to 6300 Hz
+- 1.0 dB; 31.5 to 200 Hz, 10 to 20 kHz
+- 2.0 dB; 20 to 31.5 kHz

A, B, C Weighting Filter Accuracy:
+- 0.2 dB; 1.0 kHz
+- 1.0 dB; 40 Hz to 5.0 kHz
+- 1.5 dB; 25 to 40 Hz, 5.0 to 10.0 kHz
+- 2.0 dB; 20 to 25 Hz, 10.0 to 20.0 kHz

Audio Band-pass Filter Accuracy:
22.4 Hz +- 5 %, 60 dB/decade rolloff
22.4 kHz +- 5 %, 60 dB/octave rolloff

TABLE 1-1. CONTINUED.

SOURCE SPECIFICATIONS

Frequency

Range: 10 Hz to 140 kHz

Resolution:

0.001 Hz; 10.000 to 199.999 Hz
0.01 Hz; 200.00 to 1999.99 Hz
0.1 Hz; 2.0000 to 19.9999 kHz
1.0 Hz; 20.000 to 140.000 kHz

Accuracy: 10 ppm + 1 count

Level

Range:

0.1 mV to 6 V open circuit, 10 Hz to 100 kHz
0.1 mV to 3 V open circuit, 100 kHz to 140 kHz
(6.000 V, 3.000 V, 300.0 mV full scale)

Resolution:

0.1 mV; 0.0 mV to 300.0 mV
1.0 mV; 301 mV to 3.000 V
2.0 mV; 3.002 to 6.000 V

Accuracy:

+- 0.5 % of setting + 0.1 % of range; 10 Hz to 50 kHz
+- 1.0 % of setting + 0.25 % of range; 50 kHz to 100 kHz
+- 1.5 % of setting + 0.5 % of range; 100 kHz to 140 kHz

Flatness: 30 mV to 6.0 V

+- 0.5 %; 10 Hz to 50 kHz, 1 kHz reference
+- 1.0 %; 10 Hz to 100 kHz, 1 kHz reference
+- 1.5 %; 10 Hz to 140 kHz, 1 kHz reference

Distortion and Noise: (the greater of)

0.01 % (-80 dB) or 10 uV; 10 Hz to 20 kHz, 80 kHz BW
0.02 % (-74 dB) or 20 uV; 20 to 50 kHz, 220 kHz BW
0.056 % (-65 dB) or 50 uV; 50 to 100 kHz, 500 kHz BW
0.1 % (-60 dB) or 50 uV; 100 to 140 kHz, 500 kHz BW

Output Impedance

Accuracy: 600 ohms +- 1 %

TABLE 1-1. CONTINUED.

SUPPLEMENTAL INFORMATION

AC Measurement

rms Detector: True rms responding for signals with a crest factor of < 3

Average Detector: Average responding rms calibrated

Bandwidth: > 500 kHz

Frequency Measurement

Technique: Reciprocal measurement with 10 MHz timebase

Analyzer Measurement Speed

Measurement Function:	First Reading:	Measurement Rate:
Frequency	< 1 sec	4 rdngs/sec
Level	< 1 sec	10 rdngs/sec
Distortion	< 1 sec	8 rdngs/sec
SINAD	< 1 sec	8 rdngs/sec
S/N	< 2 sec	1 rdngs/sec

GENERAL INFORMATION

Power Requirements: 100, 120, 220, 240 volts AC, 50 to 400 Hz, 50 VA

Operating Temperature: 0 to 55 degrees centigrade

Dimensions: 17.75 inches (45.1 cm) wide, 5.85 inches (14.9 cm) high, 18 inches (45.8 cm) deep

Weight: 25 lbs (11.3 kg)

Accessories Included: Spare input and output fuses and AC power cord

Accessories Available:

- 950044 Rack mounting hardware
- 950043 Chassis slide kit
- 954018 Single binding post to BNC (M)
- 954019 BNC (F) to phono plug
- 954020 Phono jack to BNC (M)
- 954021 Two conductor shielded balanced line, 36 "
- 954022 XLR Audio connector to three banana plugs

Options:

- -01 Rear panel input and output
- -11 400 Hz high-pass filter
- -12 CCITT band-pass filter
- -13 CCIR band-pass filter
- -14 CCIR/ARM band-pass filter
- -15 A weighting filter
- -16 B weighting filter
- -17 C weighting filter
- -18 Audio band-pass filter
- -19 C-Message band-pass filter

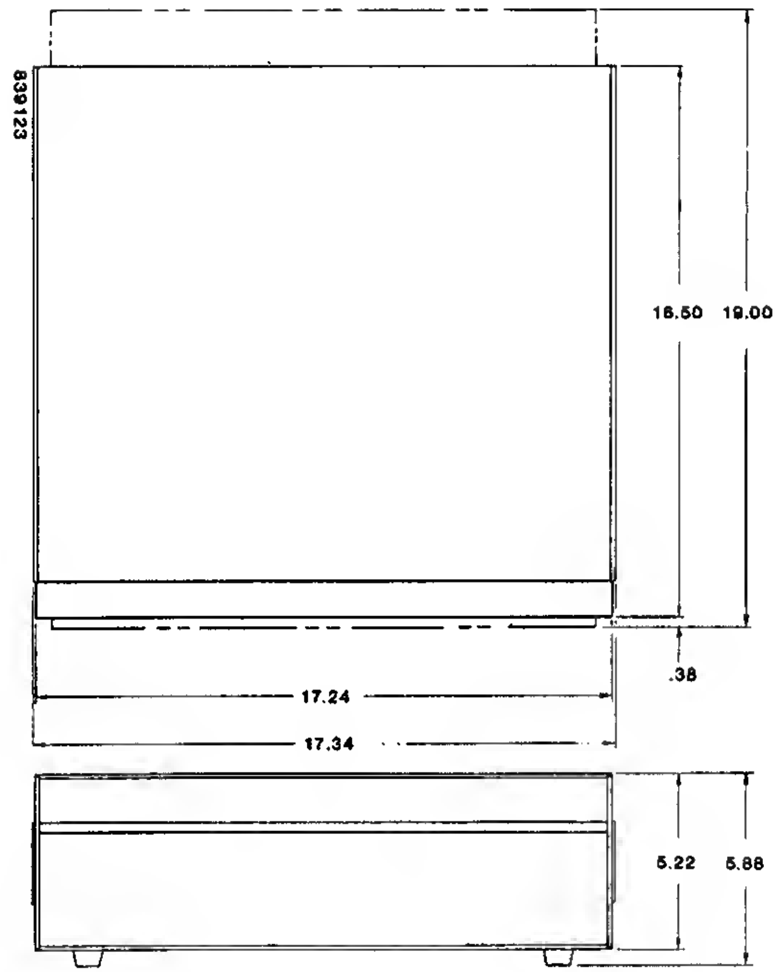

Figure 1-2. Outline Dimensions.

SECTION II
INSTALLATION

2-1. INTRODUCTION.

2-2. This section contains the unpacking, mounting, power requirements, cable connections, and preliminary check-out instructions for the Model 1120 Audio Analyzer

2-3. UNPACKING.

2-4. The instrument is shipped complete and is ready to use upon receipt. Unpack the instrument from its shipping container and inspect it for damage that may have occurred during shipment. Refer to Figure 2-1.

NOTE

Save the packing material and container for possible use in reshipment of the instrument.

2-5. MOUNTING.

2-6. For bench mounting choose a clean, sturdy, uncluttered mounting surface. For rack mounting, an accessory kit is supplied with the instrument that provides mounting ears. The rack mounting kit contains the required hardware and instructions.

2-7. POWER REQUIREMENTS.

2-8. The instrument has a tapped power transformer and two line voltage selection switches which permit operation form 100, 120, 220, or 240 volt +- 10 %, 50 to 60 Hz, single phase AC power sources. Power consumption is approximately 50 VA.

CAUTION

Always make certain that the line voltage selection switches are set to the correct positions most nearly corresponding to the voltage of the available AC poser source, and that a fuse of the correct rating is installed in the fuse holder before connecting the instrument to any AC power source.

2-9. Set the line voltage selector switches, located on the rear panel to the appropriate positions as indicated on the LINE VOLTAGE SELECT chart located next to the switches. Check that the line fuse is correct for the selected power source. The correct fuse is:

Voltage:	Fuse
100/120 V	3/4 AT MDL
220/240 V	3/8 AT MDL

2-10. CABLE CONNECTIONS.

2-11. Front panel connectors:

a INPUT. Analyzer Input HIGH and LOW BNC type connectors and chassis ground allow connection of external audio signals for analysis. The Input impedance is 100 k ohms either side to ground.

The LOW terminal is connected to chassis ground in the non-floating mode.

b. OUTPUT. Source Output HI and LOW BNC type connectors and chassis ground allow connection of the audio source to external devices. The output impedance is 600 ohms. The LOW terminal is connected to chassis ground in the non-floating mode.

2-12. Rear Panel Connectors:

a. MONITOR. The MONITOR BNC type output connector provides a scaled output of the Input signal in the Level, Frequency and S/N measurement modes and a scaled output with the fundamental removed in the Distortion and SINAD measurement modes. The output impedance is 600 ohms.

b. SYNC. The SYNC BNC type output connector provides a TTL compatible output relative to the Source oscillator frequency.

c. X CLK. The X CLK BNC type input connector provides an means of connecting to an external 10 MHz counter reference. The external reference is automatically selected when the signal is present.

d. X AXIS. The X AXIS BNC type output connector provides a 0 to 5 volt DC level to control an external X/Y recorder. The output impedance is 1000 ohms.

e. Y AXIS. The Y AXIS BNC type output connector provides a 0 to 5 volt DC level to control an external X/Y recorder. The output impedance is 1000 ohms.

f. PEN. The PEN BNC type output connector provides a TTL compatible signal to control an external X/Y recorder.

2-13. PRELIMINARY CHECK.

2.14. The preliminary check verifies that the Model 1120 is operational and should be performed before the instrument is placed into use. Set the front panel power switch to ON. Wait several seconds then depress the LCL/INIT key. The SOURCE display will contain the instrument firmware number and the other displays will contain dashes for a period of about three seconds. The SOURCE display will the contain 1000.00 Hz with the KYBD legend illuminated and the ANALYZER display will change to the [====] message for one level measurement cycle. During the initialize sequence, the instrument is internally checking the Source oscillator. If a hardware fault occurs in the oscillator frequency tuning circuits an error code (30-34) will be displayed indicating a failure requiring service. The initialize sequence also resets all functions and operating modes of the Model 1120 to the initialized values and conditions listed in Table 2-1.

2-15. Program location 99 is a

recall-only location which contains the initialize values. When the Model 1120 is powered on the instrument will execute the Source oscillator self-check. Following the self-check sequence the Model 1120 will be set to the operating conditions at the time the instrument was powered off.

TABLE 2-1. INITIAL CONDITIONS.

Analyzer Group:

AC Level function enabled
AC Level displayed in linear units of V or mV
Filters disabled
Floating input mode disabled

Source Group:

KYBD legend illuminated
Frequency function enabled and set to 1000.00 Hz
Frequency Step functions set to 0.000 Hz
Level function set to 0.0 mV
Level Step function set to 0.0 mV
Special functions 0, 10, 40, 55, and 63 are selected with 10 displayed
Floating output mode disabled

Sweep Group:

Sweep mode disabled
Start function set to 20.000 Hz
Stop function set to 20000 Hz
Low function set to 0.001 mV
High function set to 300.0 V

Bus/Prgm Group:

Address function is unchanged by initialize
Program function is set to 99
Service-Request (SRQ) is cleared
Bus status is unchanged by initialize

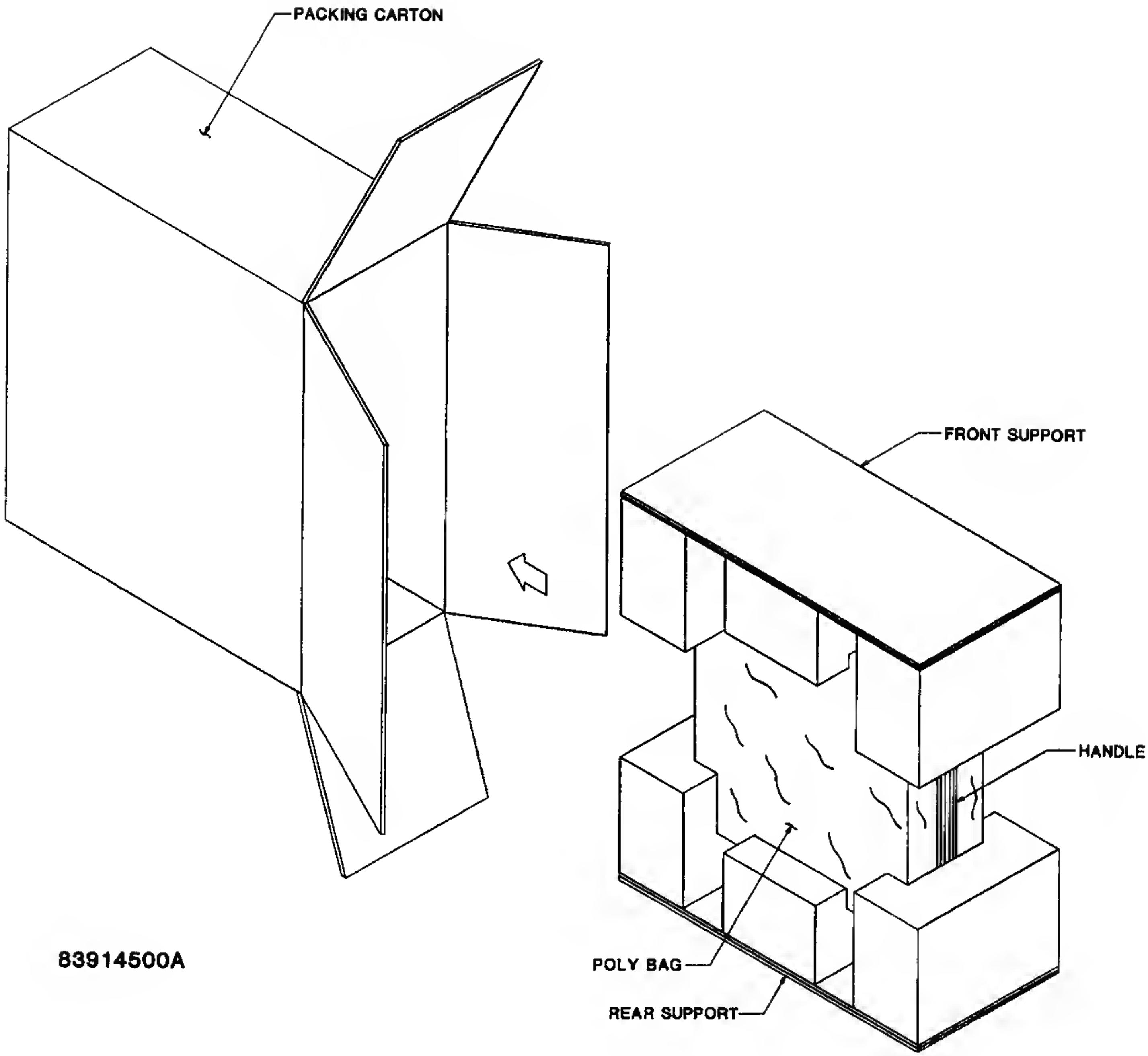

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FIGURE 2-1. Packing and Unpacking Diagram.

SECTION III
OPERATION

3-1. INTRODUCTION.

3-2. This section contains the operating instructions for the Model 1120 Audio Analyzer.

3-3. OPERATING CONTROLS, INDICATORS AND CONNECTIONS.

3-4. The controls, indicators and connectors used during the operation of the instrument are listed in Table 3-1 and shown in Figures 3-1 and 3-2.

3-5. OPERATING INSTRUCTIONS.

3-6. The operating instructions for the Model 1120 are divided into sections of Initial Conditions, Local Operation and Remote Operation.

3-7. INITIAL CONDITIONS.

3-8. Initialize the instrument as follows:

a. Connect the power cord to the instrument and to the desired power source. Refer to paragraph 2-7 for proper power application.

b. Set the front panel power switch to ON.

c. Depress the LCL/INIT key.

d. The SOURCE display will contain the instrument firmware identification number and the other displays will contain dashes for a period of about three seconds. The SOURCE display will change to contain 1000.00 Hz with the KYBD legend illuminated and the ANALYZER display will indicate the [====] message for one level measurement cycle.

3-9. During the initialization sequence, the instrument internally checks the source oscillator. If a hardware fault occurs in the oscillator frequency tuning circuits an error code (30-34) will be displayed indicating a failure requiring service.

3-10. LOCAL OPERATION.

3-11. Function Selection.
The DATA ENTRY keypad is common to all functions of the Model 1120. The KYBD legend determines the active display window to which the DATA ENTRY keypad is dedicated at any given time. To select a function simply depress the function key desired. The results will be the LED of the function key will be illuminated, the current value of the selected function will be displayed in the window above the key, and the KYBD legend will be illuminated in the display window. The DATA ENTRY keypad is now dedicated to the selected function and any unit selection or number entry will appear in the active display window. When selecting Analyzer functions the [====] message may

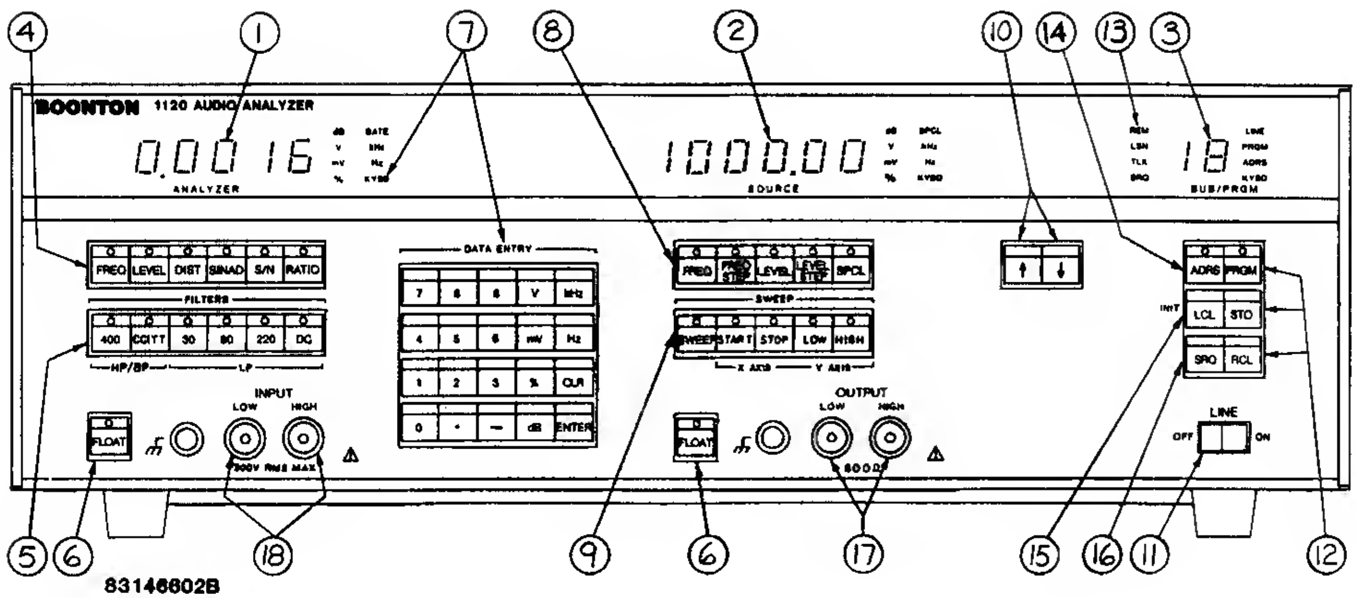

Figure 3-1. Model 1120, Front View.

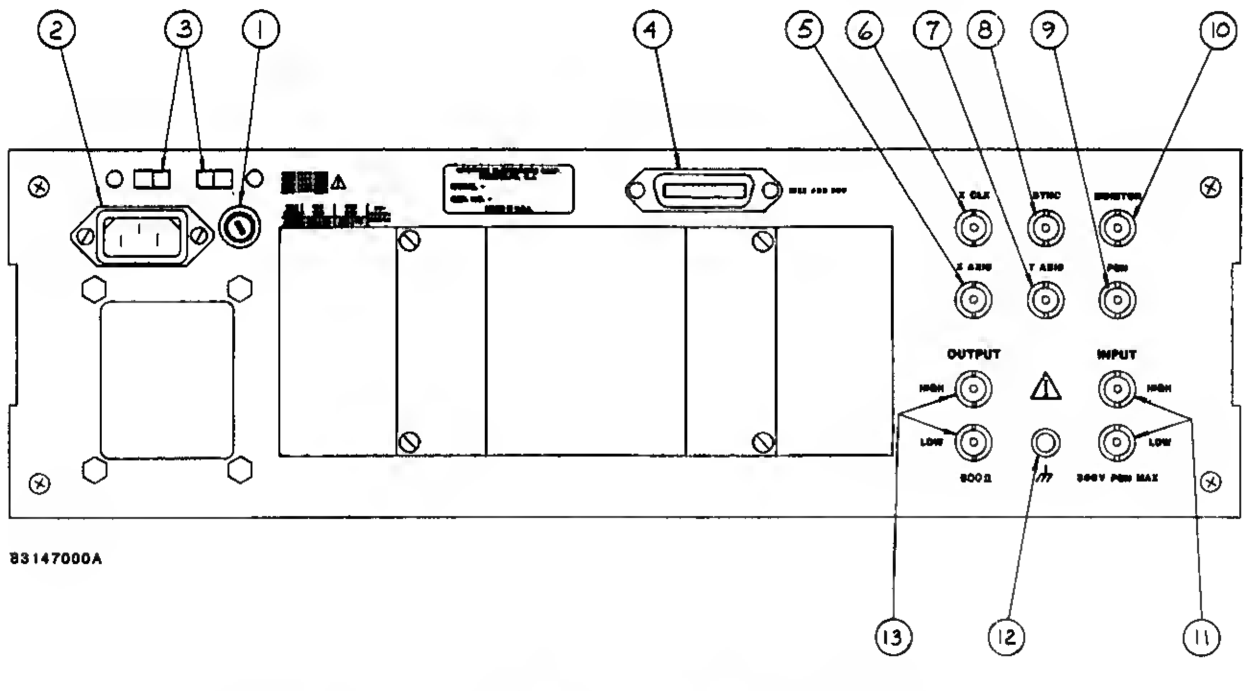

Figure 3-2. Model 1120, Rear View.

TABLE 3-1. OPERATING CONTROLS, INDICATORS, AND CONNECTORS.

Control, Indicator, or Connector	Figure and Index #	Function
ANALYZER display	3-1, 1	Displays audio frequency, AC and DC level, distortion, SINAD, S/N, and ratio measurements. (6 digit LED display)
SOURCE display	3-1, 2	Displays source frequency and level, frequency step and level step, special function, start, stop, low, and high sweep values. Alternately displays error codes and messages. (8 digit LED display)
BUS/PRGM display	3-1, 3	Displays current program number or IEEE-488 bus address. (2 digit LED display)
Analyzer keys	3-1, 4	Selects the following active analyzer functions.
FREQ key		Displayed in Hz or kHz with GATE indication.
LEVEL key		Displayed in V, mV, or dBV.
DIST key		Distortion displayed in %, dB, dBV, V, or mV. Notch tune frequency displayed in Hz or kHz. Notch capable of automatic or manual tuning.
SINAD key		Displayed in dB and the notch filter is coarse tuned to the source frequency setting.
S/N key		Displayed in dB and is measured by monitoring the AC level while turning the source level on and off.

TABLE 3-1. CONTINUED.

Control, Indicator, or Connector	Figure and Index #	Function
RATIO key		Displays amplitude related ratios in % or dB and frequency ratio (deviation) in Hz or kHz.
FILTER keys	3-1, 5	Selects optional filters or 30 kHz, 80 kHz, or 220 kHz low-pass or DC level filters.
FLOAT keys	3-1, 6	Selects floating or single-ended input and output connections.
DATA ENTRY keypad	3-1, 7	Used with the function keys to enter data into the active display designated by the KYBD annunciator.
SOURCE keys	3-1, 8	Selects the following active source functions.
FREQ key		Allows display and entry of the source oscillator frequency in Hz or kHz units.
FREQ STEP key		Allows display and entry of the frequency increment in Hz or kHz units for use with the step keys and the linear sweep mode.
LEVEL key		Allows display and entry of the source oscillator output level in mV, V, or dBV units.
LEVEL STEP key		Allows display and entry of the level increment in mV, V, or dB units for use with the step keys and the linear or log level sweep mode.

TABLE 3-1. CONTINUED.

Control, Indicator, or Connector	Figure and Index #	Function
SPCL key		Allows alteration to the normal source and analyzer modes of operation such as: range hold, notch tune hold, slow responding detector, sweep step rate and resolution, and special modes for testing, troubleshooting, and auto calibration.
SWEEP keys	3-1, 9	Selects the following sweep parameters for use with the rear panel recorder outputs.
SWEEP key		Enables the start of the sweep sequence and indicates a sweep in progress.
START key		Allows display and entry in Hz or kHz units of the starting sweep frequency or in V, mV, or dBV units of the starting sweep level.
STOP key		Allows display and entry in Hz or kHz units of the ending sweep frequency or in V, mV, or dBV units of the ending sweep level.
HIGH key		Allows display and entry of the upper Y axis scale value in V, mV, %, dB, dBV, Hz, or kHz units.
LOW key		Allows display and entry of the lower Y axis scale value in V, mV, %, dB, dBV, Hz, or kHz units.

TABLE 3-1. CONTINUED.

Control, Indicator, or Connector	Figure and Index #	Function
Step Keys	3-1, 10	Step keys increment and decrement the active source or sweep function in frequency or level step sizes and single steps the store/recall program location function.
LINE switch	3-1, 11	Switches the instrument AC power on or off.
PROGRAM keys	3-1, 12	Selects the following program functions.
PRGM key		Allows display and entry of the store/recall program location.
STO key		Stores the instrument setup at the current program location.
RCL key		Recalls the instrument setup at the current program location.
Bus status	3-1, 13	Displays the current IEEE-488 bus status; REM (remote enabled), LSN (listener addressed), TLK (talker active), and SRQ (service request).
ADRS key	3-1, 14	Allows display and entry of IEEE-488 bus address.
LCL/INIT key	3-1, 15	Causes the instrument to "go-to-local" when remote enabled otherwise executes the initialize sequence.
SRQ key	3-1, 16	Sets the IEEE-488 bus SRQ line true.

TABLE 3-1. CONTINUED.

Control, Indicator, or Connector	Figure and Index #	Function
OUTPUT connectors	3-1, 17	LOW and HIGH. Used to connect the audio source to external devices. The LOW terminal is connected to chassis ground in the non-floating mode.
INPUT connectors	3-1, 18	LOW and HIGH. Used to apply an external audio signal for analysis. The LOW terminal is connected to chassis ground in the non-floating mode.
Fuse holder	3-2, 1	AC line fuse holder.
AC connector	3-2, 2	AC power connector.
Line Voltage selector switches	3-2, 3	Selects the desired operating voltage.
IEEE-488 bus connector	3-2, 4	Provides a means for connecting the standard IEEE-488 bus interface cable.
X AXIS connector	3-2, 5	Provides a 0 to 5 VDC signal corresponding to the source oscillator frequency or level in the sweep mode.
X CLK connector	3-2, 6	Provides a TTL compatible input for an external 10 MHz timebase reference. Automatic switching to external reference when present.
Y AXIS connector	3-2, 7	Provides a 0 to 5 VDC signal corresponding to the displayed measurement value and entered high and low plot limits.
SYNC connector	3-2, 8	Provides a TTL compatible output relative to the source oscillator frequency.

TABLE 3-1. CONTINUED.

Control, Indicator, or Connector	Figure and Index #	Function
MONITOR connector	3-2, 9	In the AC level, Frequency, and S/N modes: provides a scaled output of the input signal. In the distortion and SINAD modes: provides a scaled output of the input signal with the fundamental removed.
PEN connector	3-2, 10	A TTL compatible output that provides a means to control the pen of a recorder during a sweep.
INPUT connector	3-2, 11	Rear panel input connectors which replace the front panel input connectors.
Ground connector	3-2, 12	Chassis ground connector.
OUTPUT connector	3-2, 13	Rear panel output connectors which replace the front panel output connectors.

appear to indicate that a measurement cannot be displayed instantly for any of six possible reasons:

a. The first measurement cycle is in progress and cannot be displayed.

b. The measurements' minimum signal requirements are not met such as the input level is too low.

c. The input level is over-range.

d. The input signal is changing faster than the analyzer can respond.

e. The tune-status indicates the notch filter is not tuned. (tune-status can be ignored using Special Function 15)

f. The Analyzer has been disabled during rapid sweep mode.

3-12. DATA ENTRY Operation. Once a function has been selected, new values may be en-

tered with the DATA ENTRY keypad. To enter data simply depress the desired digit keys followed by the appropriate unit key or ENTER key. During digit selection a (') mark will appear in the display to the left of the first digit selected to indicate the number in the display is in the process of being entered. No action is taken until the unit or ENTER key is depressed. The unit keys can also be used aside from number entry to select display modes. For example, to change the Source Level displayed in mV to logarithmic units in dBV, simply select the Source Level function and depress the dB key in the DATA ENTRY keypad. The display program will calculate and display the logarithmic value. The ENTER key serves a dual function as a dimensionless unit key for SPCL, ADRS, and PRGM number entry and also as a default unit terminator of V, %, and Hz for functions where more than one unit can be selected. Many of the Model 1120 Source and Analyzer functions have multiple display and entry modes. Listed in table 3-2, Function Display And DATA ENTRY Units, are the display legends which can be active for each function along with the unit keys in the DATA ENTRY keypad which select the available display modes. Argument entry ranges for all the Model 1120 functions are described in Table 3-3, Valid Function Argument Range. Number entry out of range of the selected functions will result in an error displayed in the SOURCE display window. Errors can be cleared by depressing any key. If at any time prior to entry a wrong digit is entered, depress the CLR key to clear and restore the previous display.

TABLE 3-2. FUNCTION DISPLAY AND DATA ENTRY UNITS.

Function	Display Legends	Unit Keys	Default Units (ENTER Key)
ANALYZER GROUP:			
FREQuency	Hz kHz	Hz kHz	V
LEVEL	mV V dBV dBm	mV V dB	V
DISTortion	% dB dBV dBm mV V Hz kHz	% dB mV V Hz kHz	%
SINAD	dB	dB mV V	dB
S/N	dB	dB	no entry
RATIO	% dB	% dB	no entry
SOURCE GROUP:			
FREQuency	Hz kHz	Hz kHz	Hz
FREQuency STEP	Hz kHz	Hz kHz	Hz
LEVEL	mV V dBV dBm	mV V dB	V
LEVEL STEP	mv V dB	mV V dB	V
SPeCiaL	SPCL	ENTER	dimensionless
START	Hz kHz mV V dBV dBm	Hz kHz mV V dB	Hz
STOP	Hz kHz mV V dBV dBm	Hz kHz mV V dB	Hz
LOW	% dB dBV dBm mV V Hz kHz	% dB mV V Hz kHz	V
HIGH	% dB dBV dBm mV V Hz kHz	% dB mV V Hz kHz	V
BUS/PRGM GROUP:			
ADdReSs	ADRS	ENTER	dimensionless
PRoGraM	PRGM	ENTER	dimensionless

TABLE 3-3. VALID FUNCTION ARGUMENT RANGES.

Function	Argument Range	Entry Action	Error#
ANALYZER GROUP:			
FREQuency	0 mV to 300 V	Input level range	12
LEVEL	0 mV to 300 V	Input level range	13
DISTortion	0 mV to 300 V	Input level range	14
	0 to 100 %	Distortion range (lin)	14
	-120 to 0.0 dB	Distortion range (log)	14
	5 Hz to 140 kHz	Notch tune frequency	14
SINAD	0 mV to 300 V	Input level range	15
	-120 to 0.0 dB	SINAD range (log)	15
S/N	no entry allowed		20
RATIO	no entry allowed		17
SOURCE GROUP:			
FREQuency	10 Hz to 140 kHz	Source frequency	01
FREQ STEP	0 Hz to 100 kHz	Frequency step size	02
LEVEL	0 mV to 6 V	Source Level (lin)	03
	-120 to 15.56 dBV	Source Level (log)	03
LEVEL STEP	0 mV to 6 V	Level step size (lin)	04
	0 to 120 dB	Level step size (log)	04
SPeCiaL	See table of available Special Functions		05
START	10 Hz to 140 kHz	Start frequency	06
	0 mV to 6 V	Start level	06
	-120 to 15.56 dBV	Start Level (log)	06
STOP	10 Hz to 140 kHz	Stop frequency	07
	0 mV to 6 V	Stop Level (lin)	07
	-120 to 15.56 dBV	Stop Level (log)	07
LOW	-30000 to 30000 %	Low plot limit (lin)	08
	-120 to 49.54 dB	Low plot limit (log)	08
	-300 to 300 V	Low plot limit (lin)	08
	120 to -49.54 dB	Low plot limit (S/N)	08
	-300 to 300 kHz	Low plot limit (FREQ)	08
HIGH	-30000 to 30000 %	High plot limit (lin)	09
	-120 to 49.54 dB	High plot limit (log)	09
	-300 to 300 V	High plot limit (lin)	09
	120 to -49.54 dB	High plot limit (S/N)	09
	-300 to 300 kHz	High plot limit (FREQ)	09
BUS/PRGM GROUP:			
ADdReSs	0 to 30	IEEE-488 Bus Address	10
PRoGraM	0 to 99	Store/Recall Location	11

TABLE 3-4. INPUT LEVEL RANGES.

AC Level Ranges:	DC Level Ranges:	Distortion and SINAD Input Level Ranges
300.0 to 150.1 V	300.0 to 150.1 V	300.0 to 150.1 V
150.0 to 75.01 V	150.0 to 75.01 V	150.0 to 75.01 V
75.00 to 30.01 V	75.00 to 30.01 V	75.00 to 30.01 V
30.00 to 15.01 V	30.00 to 15.01 V	30.00 to 15.01 V
15.00 to 7.501 V	15.00 to 7.501 V	15.00 to 7.501 V
7.500 to 3.001 V	7.500 to 3.001 V	7.500 to 3.001 V
3.000 to 1.501 V	3.000 to 1.501 V	3.000 to 1.501 V
1500 to 750.1 mV	1.500 to 0 mV	1500 to 750.1 mV
750.0 to 300.1 mV		750.0 to 300.1 mV
300.0 to 150.1 mV		300.0 to 150.1 mV
150.0 to 75.01 mV		150.0 to 100.1 mV
75.00 to 30.01 mV		100.0 to 0 mV
30.00 to 15.01 mV		
15.00 to 7.501 mV		
7.500 to 3.001 mV		
3.000 to 0 mV		

TABLE 3-5. DISTORTION AND SINAD RANGES.

Linear:	Logarithmic:
100.0 to 50.01 %	0.00 to -6.01 dB
50.00 to 20.01 %	-6.02 to -13.97 dB
20.00 to 10.01 %	-13.98 to -19.99 dB
10.00 to 5.001 %	-20.00 to -26.01 dB
5.000 to 2.001 %	-26.02 to -33.97 dB
2.000 to 1.001 %	-33.98 to -39.99 dB
1.000 to .5001 %	-40.00 to -46.01 dB
.5000 to .2001 %	-46.02 to -53.97 dB
.2000 to .1001 %	-53.98 to -59.99 dB
.1000 to 0 %	-60.00 to -120.00 dB

3-13. Analyzer Measurement General Description.
The Model 1120 contains an independent Audio Analyzer which can measure frequency, AC and DC level, distortion, SINAD, and signal-to-noise ratio. In addition, ratiometric measurements can be made with all Analyzer functions. A wide range of special functions enhance the basic measurement modes without sacrificing the simplified operation of the Analyzer. Standard and optional audio filters are provided to aid in harmonic distortion analysis and weighted noise measurements. The Audio Analyzer incorporates a user configurable sweep mode which is used to sweep the Source oscillator's level or frequency while monitoring the Analyzer for settled measurements. The results are presented in the ANALYZER display window and generate X Axis, Y Axis and Pen control for plotter recorders. Finally, the ability to store and recall specific measurement combinations aid in configuring measurement applications for manual and remote use.

3-14. Analyzer Input Description.
The input configuration of The Audio Analyzer can be selected for single-ended or balanced/differential operation. The input mode can be enabled using the front panel FLOAT key or over the IEEE-488 bus interface.

3-15. Analyzer Frequency Measurement Function.
The Model 1120 Measures wide ranges of audio frequency with high accuracy and resolution. Microprocessor control of the reciprocal counter results in automatic selection of frequency ranges for maximum resolution. Measurements are referenced to an internal 10 MHz timebase accurate to 0.0001 % and external reference capability ia also provided.

3-16. Frequency Measurement Display Units.
Frequency measurements can be displayed in Hz or kHz for values above 199.999 Hz with automatic selection of Hz units below this limit. To select the Frequency measurement function simply depress the FREQ key which illuminates both the key's LED and the KYBD legend in the ANALYZER display. Display units can then be selected by depressing the appropriate units associated with the desired display mode. For example, to select frequency in Hz units depress the Hz key and to select kHz units depress the kHz key.

3-17. Special Frequency Measurement Modes of Operation.
Special function 11 is provided to preset and hold specific level ranges for frequency measurement. Faster first measurement rates can be achieved in this manner. The frequency measurement mode can function to input levels 40 db below the selected level range. For example by setting the 3.000 volt level range, measurements can be made with signal levels as low as 30 mV.

3-18. Frequency Measurement Error Codes.
Error codes associated with Analyzer frequency measurement

operation are listed below:

12 Number entry out of range
20 Illegal units

3-19. Analyzer Level Measurement Function.

The Model 1120 measures both AC and DC voltage with high dynamic range and variable AC bandwidth. Resolution at full scale is 3000 counts with an additional 20 % overrange capability. The AC rms detector is true rms responding for signals with a crest factor of < 3. A period sampling measurement technique is employed which results in variable measurement rates optimized by the period of the dominant AC component. This technique enables fast settled measurements in the AC level mode while rejecting large AC components in the DC level mode.

3-20. Level Measurement Display Units.

AC and DC Level measurements can be displayed in linear or logarithmic units. Linear measurements are displayed in mV or V with V automatically selected for levels above 750 mV and mV automatically selected for levels below 0.300 V. Logarithmic measurements are displayed in various forms. The default mode uses dBV units (dB relative to 1.000 V rms). In addition, dBm units can be selected for various impedances as described in paragraph 3-84. To select the Level measurement function simply depress the LEVEL key which illuminates both the key's LED and the KYBD legend in the ANALYZER display. The various display modes can then be selected by depressing the appropriate units associated with the desired display mode. For example, to select AC level in logarithmic units depress the dB key and to return the display to linear units depress the mV or V keys.

3-21. Special Level Measurement Modes of Operation.

Special capability is provided to preset and hold specific level ranges for level measurement. Faster first measurement rates can be achieved in this manner. A noise rejecting special function is provided to extend the measurement sampling period to provide a more consistent reading in the presence of noise. AC and DC calibration is performed through the use of special function codes along with selection of the AC rms or average detector type. Special function codes associated with Analyzer level measurement operation are listed below:

11 Range hold
17 Slow detector
20 AC full scale calibration
21 Optional filter # 1 calibration
22 Optional filter # 2 calibration
23 DC offset calibration
24 DC full scale calibration
26 Set 3.000 V range
27 Set 30.00 V range
28 Set 300.0 V range
70 rms detector enabled
71 Average detector enabled
80 dBV display mode
81 dBm/50 ohms display mode
82 dBm/75 ohms display mode
83 dBm/150 ohms display mode
84 dBm/300 ohms display mode
85 dBm/600 ohms display mode
86 dBm/900 ohms display mode

3-22. Level Measurement Error Codes.

Error codes associated with Analyzer level measurement operation are listed below:

13	Number entry out of range
20	Illegal units
40	Auto calibration error on post notch rms detector
41	Auto calibration error on post notch average detector
42	Auto calibration error on input rms detector
43	Auto calibration error on DC detector at full scale
45	Auto calibration error on optional filter # 1
46	Auto calibration error on DC detector offset
47	Auto calibration error on optional filter # 2

3-23. Analyzer Distortion Measurement Function.

The Model 1120 measures total harmonic distortion and noise over a wide range of frequency. The notch filter is automatically tuned to reject the fundamental frequency and pass only the harmonic and noise content. The AC measurement techniques are similar to those used in the Level measurement function yielding fast settled measurements. Measurement bandwidth is selectable to reject noise while accurately preserving harmonic components. Measurement results can be displayed in several forms. The combination of harmonics and noise can be displayed as an absolute level or as a percentage of the total input signal consisting of fundamental, harmonics and noise.

3-24. Distortion Measurement Display Units.

Distortion measurements can be displayed in linear or logarithmic units. Linear ratiometric measurements are displayed in % while logarithmic measurements are displayed in dB where 0.00 dB is referenced to 100.0 %. Distortion Level is displayed in the same format as the AC level function. In addition the notch tuning frequency can be displayed in Hz or kHz. To select the Distortion measurement function simply depress the DIST key which illuminates both the key's LED and the KYBD legend in the ANALYZER display. The various display modes can then be selected by depressing the appropriate units associated with the desired display mode. For example, to select distortion level in logarithmic units (dBV or dBm) depress the DIST key followed in sequence by the mV or V keys and the dB key. The mV or V keys select the distortion measurement to be displayed as an absolute level and the dB key converts the results to logarithmic units.

3-25. Special Distortion Measurement Modes of Operation.

Special capability is provided to preset and hold specific input level and distortion ranges. Faster first measurement rates can be achieved in this manner. A noise rejecting special function is provided to extend the measurements sampling period to provide a more consistent reading in the presence of noise. Notch filter tuning can be preset and held at specific frequencies to aid in tuning the notch filter

in the event that a stable frequency measurement can not be achieved or to enable notch filter tuning to frequencies other than the fundamental. Special function codes associated with Analyzer distortion measurement operation are listed below:

12 Input range hold
13 Post notch detector range hold
14 Notch hold and ignore tuning status
17 Slow detector
70 rms detector enabled
71 Average detector enabled
80 dBV display mode
81 dBm/50 ohms display mode
82 dBm/75 ohms display mode
83 dBm/150 ohms display mode
84 dBm/300 ohms display mode
85 dBm/600 ohms display mode
86 dBm/900 ohms display mode

3-26. Distortion Measurement Error Codes.
Error codes associated with Analyzer distortion measurement operation are listed below:

14 Number entry out of range
19 Unable to enter Ratio mode while displaying frequency
20 Illegal units

3-27. Analyzer SINAD Measurement Function.
The Model 1120 measures SINAD (SIgnal-to-Noise And Distortion) in the same manner as the Distortion measurement except that the notch filter is coarse tuned to the frequency of the internal Source oscillator to permit measurements in the presence of large amounts of noise. If an external oscillator is used, it must be tuned to within 3 % of the internal oscillator frequency. The AC measurement techniques are similar to those used in the level measurement function yielding fast settled measurements. Measurement bandwidth is selectable to reject noise while accurately preserving harmonic components. The combination of harmonics and noise is displayed as a percentage of the total input signal consisting of fundamental, harmonics and noise.

3-28. SINAD Measurement Display Units.
SINAD measurements are only displayed in dB units. To select the SINAD measurement function simply depress the SINAD key which illuminates both the key's LED and the KYBD legend in the ANALYZER display.

3-29. Special SINAD Measurement Modes of Operation.
Special capability is provided to preset and hold specific input level and SINAD ranges. Faster first measurement rates can be achieved in this manner. A noise rejecting special function is provided to extend the measurements sampling period to provide a more consistent reading in the presence of noise. Special function codes associated with Analyzer SINAD measurement operation are listed below:

12 Input range hold
13 Post notch detector range hold
15 Ignore tuning status
17 Slow detector
70 rms detector enabled
71 Average detector enabled

3-30. SINAD Measurement Error Codes.
Error codes associated with

Analyzer SINAD measurement operation are listed below:

15 Number entry out of range
20 Illegal units

3-31. Analyzer Signal-to-Noise Measurement Function.
The Model 1120 measures Signal-to-noise by alternately turning the Source oscillator output on and off and calculating the ratio of the two measurements. The AC measurement techniques are similar to those used in the Level measurement function yielding fast settled measurements. Measurement bandwidth is selectable to reject out-of-band noise and to allow various weighting characteristics.

3-32. S/N Measurement Display Units.
Signal-to-noise measurements are only displayed in dB units. To select the S/N measurement function simply depress the S/N key which illuminates the key's LED and the KYBD legend in the ANALYZER display.

3-33. Special S/N Measurement Modes of Operation.
A noise rejecting special function is provided to extend the measurements sampling period to provide a more consistent reading in the presence of noise. In some measurement situations it is necessary to provide additional delay between the signal level measurement and the noise level measurement. This delay provides time for the device under test to settle and can be programmed in 200 mS increments. Special function codes associated with Analyzer S/N measurement operation are listed below:

17 Slow detector
40 Automatic selection of S/N delay
41 200 mS delay
42 400 mS delay
43 600 mS delay
44 800 mS delay
45 1.0 Sec delay
46 1.2 Sec delay
47 1.4 Sec delay
48 1.6 Sec delay
49 1.8 Sec delay
70 rms detector enabled
71 Average detector enabled

3-34. S/N Measurement Error Code.
The error code associated with Analyzer S/N measurement operation is listed below:

20 Illegal units

3-35. Analyzer Ratio Measurement Mode.
The Model 1120 enables all measurement modes to be displayed as a relative value to a previous measurement value. In a ratiometric measurement, such as a flatness response, amplitude measurements at various frequencies are displayed relative to a reference level at a frequency of 1 kHz. Other possible ratiometric measurements include direct display of the percent of AC ripple on a DC level.

3-36. Ratio Measurement Display Units.
Ratiometric level measurements are displayed in % or in dB units while frequency ratio measurements are displayed in Hz or kHz units. To select the Ratio mode simply depress an Analyzer measurement key such as LEVEL followed by the RATIO

key. The LEDs of both keys will be illuminated along with the KYBD legend in the Analyzer display. When the next measurement cycle is complete, the measurement value will become the ratio reference and the display will indicate 100.00 % or 0.00 dB depending on the previous log/linear display mode. Selection of display units can be made by depressing either the % or dB keys. On subsequent measurement cycles the results will be displayed relative to the original ratio reference. The RATIO key is an alternate action key, therefore, depressing the RATIO key again will deselect the Ratio mode, extinguish the key's LED and return the display to the normal measurement mode. If another measurement function is selected while the Ratio mode is active, the LED on the RATIO key will be extinguished but the ratio reference is preserved for the original measurement function and can be reactivated by depressing the original measurement function key. The Ratio mode is limited to only one reference value and the old ratio reference is lost if the Ratio mode is activated in an alternate measurement function.

3-37. Ratio Measurement Error Codes.
Error codes associated with Analyzer ratio mode operation are listed below:

17 Attempting to enter an Analyzer setting while in the Ratio mode
18 Ratio display overrange
19 Unable to enter Ratio mode while displaying notch tune frequency
20 Illegal units

3-38. Analyzer Filter Measurement Mode.
The Model 1120 is equipped with low-pass and optional filters. The filter selection is determined by the type of measurement to be made. The minimum bandwidth consistent with the measurement bandwidth should be used to minimize noise errors. For example, when measuring the distortion of a 1 kHz fundamental tone, the 30 kHz low-pass filter is recommended. The DC low-pass filter is provided to attenuate all AC components and measure DC level directly. The DC low-pass filter can only be activated in the Analyzer Level mode. Band-pass filters are combinations of high and low-pass filters and are used in some measurements to simulate the sensitivity of the human ear to the audible frequency spectrum. High-pass filter selection is used to eliminate power line harmonics when present. The 400 Hz high-pass filter typically provides more than 80 dB of attenuation at 60 Hz. The audio filter keys are alternate action keys. The audio filters are only used in level related measurements and are inactive in the Frequency measurement mode. The optional filters are mutually exclusive; therefore, depressing one of the keys will cancel the other. The same is true of the low-pass filters, only one low-pass filter can be used at a time. The DC filter, however, is mutually exclusive with all filters and will also be canceled by selecting any measurement function other than Level.

3-39. Source Oscillator General Description.
The Model 1120 contains an independent Source oscillator which can be programmed in both frequency and level. The SOURCE display indicates the selected Source function and its value. The Source oscillator frequency tuning is microprocessor controlled to yield high accuracy and resolution. In applications where measurement speed is of high concern, the frequency lock can be disabled using Special Function 16. The output level of the Source can be varied in very fine increments over a wide range of levels. Levels can be set in either linear or logarithmic units to accommodate existing test procedures and applications. The Source oscillator incorporates a user configurable sweep mode which can be programmed to sweep the Source oscillator frequency or level in logarithmic or linear increments. In the sweep mode the Source can be used independent of the Analyzer as a rapid incremental sweep generator or in coordination with the Analyzer to generate hard-copy results on an X-Y plotter.

3-40. Source Oscillator Output Description.
The Output configuration of the Source can be selected for single-ended or balanced/floating operation. The output mode can be enabled using the front panel FLOAT key or over the IEEE-488 bus interface.

3-41. Source Frequency Display And Selection.
To select the Source Frequency function simply depress the FREQ key which illuminates both the key's LED and the KYBD legend in the Source display. The current Source frequency setting will be displayed in the SOURCE display window. Once the function is selected a new frequency may be entered using the DATA ENTRY keypad. Display units can be selected by depressing either the HZ or KHZ keys.

3-42. Source Frequency Lock Mode Description.
The Source oscillator achieves high frequency accuracy and resolution through the use of a frequency lock technique. The design of the Model 1120 enables internal measurement of the Source oscillator frequency. When the instrument executes its initialization self-check after power is applied or when the LCL/INIT key is depressed, the source oscillator is sequenced through its five frequency bands and specific frequencies settings are verified for accuracy. Any initial frequency inaccuracy is stored in internal memory as calibration factors by the control program. If the source fails to oscillate on any of the 5 frequency bands, an error (30-34) will be displayed as an indication of a hardware fault requiring service.

3-43. When a frequency setting is entered the Source oscillator is coarse tuned to the setting by the control program. Thereafter, the internal frequency of the Source is measured on alternate measurement cycles with the Analyzer and fine adjustments are made by the control program to tune

the oscillator to within tolerance. Special function 16 disables the frequency lock mode to enable faster measurement and sweep rates where the full frequency accuracy of the source is not required.

3-44. Source Level Display And Selection.
To select the Source Level function simply depress the LEVEL key which illuminates both the key's LED and the KYBD legend in the Source display. The current Source level setting will be displayed in the SOURCE display window. The Source level function in linear mV and V units displays the open-circuit voltage with a 600 ohm source impedance, therefore, the voltage across a 600 ohm load is half the displayed value. The Source level can also be displayed as a logarithmic value. Special functions 80 through 86 select the logarithmic display mode where 80, dBV, is the default selection. When a dBm mode is selected, the value displayed is the power dissipated in the specified load impedance (50 through 900 ohms). Once the function is selected a new level may be entered using the DATA ENTRY keypad. Display units can be selected by depressing either the mV, V, or dB keys.

3-45. Source Frequency and Level Error Codes.
Error codes associated with Source frequency and level operation are listed below:

01	Frequency entry out of range
03	Level entry out of range
30	Oscillator hardware fault on band 0
31	Oscillator hardware fault on band 1
32	Oscillator hardware fault on band 2
33	Oscillator hardware fault on band 3
34	Oscillator hardware fault on band 4

3-46. Step Size and Step Key Operation.
The keys marked with up and down arrows are used to increment and decrement function values in the active window designated by the KYBD legend. If an arrow key is constantly depressed, the stepping will repeat. Functions which can be stepped are Program number, Source Frequency, Source Level, Start, and Stop. Attempting to step any Analyzer function will result in the [====] message being displayed. Stepping any other function has no effect.

3-47. Increment/Decrement Program Number.
The Program number can be stepped in single increments. A special Auto-recall function is provided which automatically executes the recall operation after the program location function has been incremented or decremented with the step keys. This function allows rapid recall of sequential program setups by using a single key or bus mnemonic. The auto-recall function can be enabled or disabled using the internal Option switch A4S1-5 or Special Functions 7 and 8.

3-48. Increment/Decrement Frequency Values.
Frequency values in the Source Frequency, Start, and Stop

functions can be stepped by the value in the Frequency Step function. Available Frequency Step sizes are listed in Table 3-3, Valid Function Argument Range. The Frequency Step size also functions as the step size for the linear frequency sweep mode.

3-49. Increment/Decrement Level Values.
Level values in the Source Level, Start, and Stop functions can be stepped by the value in the Level Step function. Level Step sizes can be linear or logarithmic values. Available Level Step sizes are listed in Table 3-3, Valid Function Argument Range. The Level Step size also functions as the step size for the linear or logarithmic level sweep modes.

3-50. Step Size and Step Key Special Functions.
Special function codes associated with frequency and level step sizes and step key operation are listed below:

7 Disables program auto-recall
8 Enables program auto-recall
50 Variable linear frequency sweep, Frequency Step value determines resolution

3-51. Step Size Error Codes.
Error codes associated with frequency and level step size operation are listed below:

02 Frequency Step entry out of range
04 Level Step entry out of range

3-52. Program Store And Recall Description.
The entire status of the Model 1120, including all functions, entered values and display modes, can be saved in a program location of non-volatile memory for recall at a later time. Up to 99 such programs (0-98) can be stored and recalled.

3-53. Store Operation.
To save the complete front-panel setup in the program memory, first set all the desired instrument operating parameters to be stored. Next depress the PRGM key and enter the desired program location with the DATA ENTRY keypad and the ENTER key. Finally, depress the STO key to save the complete instrument status in program memory. Below is a list of all the parameters which are retained in program memory.

1. All entered values of all functions.
3. All selected Source and Analyzer functions.
2. All filter and floating settings.
3. All display modes and display units selections.
4. Ratio mode reference and ratio status.
5. All Special Functions settings
6. All Analyzer range and tune settings.

3-54. Recall Operation.
To recall the front-panel setup in the program memory, depress the PRGM key and enter the desired program location with the DATA ENTRY keypad and the ENTER key. After the memory location has been selected,

depress the RCL key. The Analyzer display will indicate the [====] message until the next measurement cycle is complete. Program location 99 is a recall-only location that restores the initialize parameters in the same manner as the LCL/INIT key. Any panel setting may be changed after recalling a program location. A special Auto-recall function is provided which automatically executes the recall operation after the program location function has been incremented or decremented with the Step keys. This function allows rapid recall of sequential program setups by using a single key or bus mnemonic. The Auto-recall function can be enabled or disabled using the internal Option switch A4S1-5 or Special Functions 7 and 8.

3-55. Program Memory Initialization.
In normal use the internal memory is never erased, new programs are simply written over the old ones. It is necessary, however, to erase the program memory after a new firmware revision has been installed or after the CPU circuit board has been serviced. Entering Special Function 25 will erase the entire program memory. Attempting to recall an erased program will result in Error 11 being displayed. Special function 25 can be disabled using the internal Option switch A4S1-4.

3-56. Program Store and Recall Special Functions.
Special function codes associated with store and recall operation are listed below:

7	Disables program auto-recall
8	Enables program auto-recall
25	Erase all program memory locations 0 through 98

3-57. Program Store and Recall Error Code.
The error code associated with store and recall operation is listed below:

11	Program location entry out of range or attempting to recall an erased location or attempting to store in read-only location 99

3-58. Sweep Mode Operation.
The Model 1120 provides a user programmable sweep capability which simplifies time consuming measurements such as flatness, gain, distortion vs. power output, and SINAD vs. frequency, and does not require the use of an external controller. In the sweep mode the Source oscillator is used as the stimulus and can be configured to sweep frequency or level in linear or logarithmic steps. The Source oscillator provides the X axis information for the rear panel plotter output. The Y axis information is based on the selected Analyzer function. All Analyzer measurement modes can be used for plotting. Five Sweep group keys are provided for easy plotter configuration: SWEEP, START, STOP, LOW, and HIGH.

3-59. Sweep Key Description.
The SWEEP key is an alternate action key which initiates and terminates the sweep. The key's LED indicates a sweep is in progress and will be illuminated for the period of one

sweep.

3-60. Start and Stop Function Description.
The START key allows entry of either the frequency or level start value. The start value defines the origin of the X axis which corresponds to 0 volts at the X AXIS output connector. When the START key is depressed the SOURCE display will contain the start value and 0 volts is presented at the X AXIS output connector as an aid in setting the offset adjustment on most X-Y plotters. The start value can be either a Source level or frequency and the value selected will be generated by the Source oscillator while the function is active.

3-61. The STOP key allows entry of either the frequency or level stop value. The stop value defines the end of the X axis which corresponds to 5 volts at the X AXIS output connector. When the STOP key is depressed the SOURCE display will contain the stop value and 5 volts is presented at the X AXIS output connector as an aid in setting the sensitivity adjustment on most X-Y plotters. The stop value can be either a Source level or frequency and the value selected will be generated by the Source oscillator while the function is active.

3-62. Low and High Funotion Description.
The LOW key allows entry of the Y axis origin value. The low value corresponds to 0 volts at the Y AXIS output connector. The HIGH key allows entry of the Y axis maximum value. The high value corresponds to 5 volts at the Y AXIS output connector.

3-63. Y Axis Operation.
The Y AXIS output of the Model 1120 is the scaled result of the Analyzer measurement relative to the high and low plot limits. There are 4096 possible points of resolution over the range of 0 to 5 volts d.c. on the Y axis. Various measurement modes and applications require greater measurement settling before a data point is generated. The Model 1120 allows for user configurable settling times using Special Functions 61 through 69. The settling time is based on the number of consecutive measurement cycles achieved before a data point is plotted. Special function 60 disables the Analyzer and the Y AXIS output and allows the Model 1120 to be used as a rapid incremental sweep generator with X axis and pen control. The high and low plot limits are always displayed in the same units as the active Analyzer display function. The Y AXIS output will be scaled linearly or logarithmically depending on the Amalyzer display units. For example, if the Analyzer distortion measurement is displayed in % units the result will be plotted linearly between the high and low plot limits and if displayed in dB units the result will be a logarithmic plot. Analyzer measurements displayed in V or mV units will be plotted linearly and measurements displayed in dBV units will be plotted logarithmically.

3-64. X Axis Operation.
The X AXIS output of the Model 1120 is the scaled result of

the Source frequency or level relative to the start and stop values. The Source can be swept in level or frequency with 4096 points of resolution on the X axis. Selection of a level or frequency sweep is determined by the type of start and stop values entered: start and stop level entries designate a level sweep and start and stop frequency entries designate a frequency sweep.

3-65. When the SWEEP key is depressed the start value is transferred to the Source level or frequency function, the function key's LED is illuminated, and the KYBD legend is illuminated in the Source window. When the sweep is in progress the X AXIS output will produce an incrementing voltage between 0 and 5 volts. The start and stop values must be compatible in level or frequency units or an error will be displayed when the SWEEP key is depressed.

3-66. Pen Operation.
The Model 1120 generates a pen control output for use with an X-Y plotter. The active state of the PEN output is selected using Option switch A4S1-3 or Special Functions 5 and 6. When the sweep sequence is initiated the X and Y axis information is presented at the plotter outputs and after an approximate 1 sec delay the PEN output is set true. After the sweep is terminated the PEN output is immediately set false. The PEN output can be set independent of any sweep operation using the PU and PD bus mnemonics.

3-67. Frequency Sweep.
The Model 1120 can generate user configurable frequency sweep sequences up to the entire frequency range of the Source oscillator in logarithmic or linear increments. The range of the sweep is defined by the start and stop values which can be in ascending or descending order. Logarithmic frequency increments are selected using Special Function 51 through 59 and vary from 16 to 4096 steps. Linear frequency increments are selected using Special Function 50 and the frequency step function defines the increment value. Linear sweep step sizes which exceed the X axis resolution limit of 4096 steps are allowed, however, the X AXIS output voltage will dwell at the same level for more than one frequency increment.

3-68. Level Sweep.
The Model 1120 can generate user configurable level sweep sequences up to the entire level range of the Source oscillator in logarithmic or linear increments. The range of the sweep is defined by the start and stop values which can be in ascending or descending order. Logarithmic and linear level increments are selected using the level step function. Special Functions 50 through 59 have no effect on level sweep. A logarithmic level sweep is defined by a level step value expressed in dB units and a linear level sweep is defined by a level step value expressed in mV or V units. Level sweep step sizes which exceed the X axis resolution limit of 4096 steps are allowed, however, the X AXIS output voltage will dwell at the same level for

more than one level increment.

3-69. Termination and Resumption of the Sweep Mode.
The sweep mode will be terminated if any number entry is attempted, any function is selected other than the functions displayed at the start of the sweep sequence, or either the SWEEP key or the LCL/INIT key is depressed. Selecting filters, floating modes, and display units will not terminate the sweep mode. If a sweep has been terminated, it can be resumed by selecting the appropriate sweep level or frequency function which will display the sweep value at the time the sweep was terminated and depressing the SWEEP key. The sweep will be activated and will resume from the displayed value until the stop value has been reached.

3-70. Sweep Mode Special Functions.
Special function codes associated with sweep mode operation are listed below:

5	PEN output: pen-up is active high
6	PEN output: pen-up is active low
50	Variable linear frequency sweep, Frequency Step value determines resolution
51	16 step logarithmic frequency sweep
52	32 step logarithmic frequency sweep
53	64 step logarithmic frequency sweep
54	128 step logarithmic frequency sweep
55	256 step logarithmic frequency sweep
56	512 step logarithmic frequency sweep
57	1024 step logarithmic frequency sweep
58	2048 step logarithmic frequency sweep
59	4096 step logarithmic frequency sweep
60	Rapid Source Sweep (disable Analyzer)
61	1 Analyzer measurement
62	2 Analyzer measurements
63	3 Analyzer measurements
64	4 Analyzer measurements
65	5 Analyzer measurements
66	6 Analyzer measurements
67	7 Analyzer measurements
68	8 Analyzer measurements
69	9 Analyzer measurements

3-71. Sweep Mode Error Codes.
Error codes associated with sweep mode operation are listed below:

06	Sweep Start entry out of range
07	Sweep Stop entry out of range
08	Sweep Low entry out of range
09	Sweep High entry out of range
20	Illegal units for active function
25	Sweep error: Start and Stop units are not compatible
26	Sweep error: High and Low values are equal or Start and Stop values are equal

3-72. Special Function Description.
The Model 1120 provides special modes of operation for specific measurement situations. Special function modes can be selected using the SPCL key and the DATA ENTRY keypad.

3-73. Option Switch functions.
Codes 0 through 8 supersede

current settings of the internal Option switch, A4S1. The Option switch settings are restored on power-up, by executing special function 0, or by depressing the LCL/INIT key.

3-74. Mode Alteration functions.
Codes 11 through 19 alter the normal operation of the Source and Analyzer. When selected, the SPCL legend in the Source window will remain illuminated as an indication of the special operating mode regardless of the Source function displayed.

3-75. The range-hold functions, 11 through 13, affect the Analyzer measurements by defeating the autorange capability. The current level or distortion range can be held at its present value by entering the appropriate special function code. Other ranges can be set and held by selecting the desired Analyzer measurement mode and entering the level or distortion range directly into the Analyzer display window using the DATA ENTRY keypad. Available level and distortion ranges for all Analyzer measurement modes are listed in Table 3-4. It is not necessary to enter the exact full scale value to set a range, rather the value need only fall within the desired range. When a range is selected the appropriate special code will automatically be activated and the SPCL legend will be illuminated. Range-hold mode is cleared by selecting an alternate Analyzer function, using Special 10 or depressing the LCL/INIT key.

3-76. The notch-hold and ignore-tune-status functions, 14 and 15, affect the Analyzer distortion and SINAD measurement modes by defeating the auto-tune capability in the distortion mode and disabling the tune-status information in both distortion and SINAD modes. Tune-status information can be unreliable in the presence of very high distortion and SINAD readings resulting in the [====] message being displayed. Independent notch tuning enables the Distortion mode circuits to function as a programmable notch filter to attenuate selected tones other than the fundamental. These special modes can be activated by entering the special code or by selecting the Analyzer distortion mode and entering the notch frequency directly into the Analyzer display window using the DATA ENTRY keypad. Direct entry of the notch frequency will automatically select Special 14 and the SPCL legend will be illuminated. Notch-hold and ignore-tune-status modes are cleared by using Special 10 or depressing the LCL/INIT key.

3-77. The source unlock function, 16, is provided to speed repetitive Analyzer measurements. In normal operation the Source oscillator frequency is measured alternately with the active Analyzer measurement. After measuring the actual Source frequency the frequency deviation is then calculated and corrected by the microprocessor circuits. Inhibiting the frequency lock operation results in faster Analyzer measurement cycles at the cost of Source frequency accuracy. The unlock mode is

cleared by using Special 10 or depressing the LCL/INIT key.

3-78. The slow detector function, 17, is provided to extend the level measurement sampling time to provide more consistent reading in the presence of noise. The level measurement employs a period sampling technique which adjusts the measurement period to include the period of the dominant AC signal. This process is extended to include low frequency components which cause inconsistent readings. The slow detector mode is cleared by using Special 10 or depressing the LCL/INIT key.

3-79. Automatio Calibration And Test Functions.
Codes 20 through 39 are used in calibration and troubleshooting of the Model 1120. These functions can be disabled using Option switch A4S1-4 to prevent accidental use resulting in possible loss of current calibration and memory data.

3-80. Signal-to-Noise Delay Functions.
Codes 40 through 49 provide user configurable delay between the signal measurement and noise measurement and allow some devices under test time to respond to the change in output level during the Signal-to-Noise measurement cycle.

3-81. Frequenoy Sweep Resolution Funotions.
Codes 50 through 59 allow selection of linear or logarithmic frequency sweep modes and logarithmic sweep resolution.

3-82. Sweep Settling Time Functions.
Codes 60 through 69 allow selection of the number of consecutive measurement cycles for each sweep step. The last measurement value is used to generate the Y Axis data point before the Source is stepped.

3-83. AC Detector Selection Funotions.
Codes 70 and 71 allow selection of the AC detector type. The default mode after initialization is the rms detector, code 70.

3-84. dBV/dBm Display Mode Selection Functions.
Codes 80 through 86 are used to select the type of logarithmic display calculation. All Source and Analyzer logarithmic amplitudes will be displayed in the form selected. The default mode after initialization is dBV units, code 80.

TABLE 3-6. SPECIAL FUNCTIONS.

Option Switch A4S1 Functions:

0	Option Switch: Restores current settings		
1	EOS Character:	Listen: LF or CR LF	Talk: CR LF
2	EOS Character:	Listen: CR	Talk: CR LF
3	EOS Character:	Listen: CR	Talk: CR
4	EOS Character:	Listen: CR	Talk: CR
5	PEN output: pen-up active high		
6	PEN output: pen-up active low		
7	Auto Recall: Disables program auto recall		
8	Auto Recall: Enables program auto recall		

Mode Alteration Functions:

10	Clear functions 11 through 19
11	Range Hold: input voltage range and post notch detector range
12	Range Hold: input voltage range only
13	Range Hold: post notch detector range only
14	Notch Hold: hold notch frequency tuning at preset frequency and ignore tune status (inactive in SINAD mode)
15	Ignore Tune Status: display SINAD measurements without regard to notch tuning
16	Unlock: inhibits Source Frequency lock mode
17	Slow Detector: noise rejecting filter response

Automatic Calibration And Test Functions:

20	Auto Cal AC Level: 1.0 kHz, 3.000 Volts
21	Auto Cal HP Filter: 1.0 kHz, 3.000 Volts
22	Auto Cal Optional Filter: 800 Hz, 3.000 Volts
23	Auto Cal DC Offset: Input shorted
24	Auto Cal DC Level: 3.000 Volts DC
25	Erase all program memory locations
26	300 Volt range - special calibration mode
27	30 Volt range - special calibration mode
28	3 Volt range - special calibration mode
30	DAC test mode
31	Counter plug-in board test mode
32	Input plug-in board test mode
33	Filter plug-in board test mode
34	Notch and Detector plug-in board test mode

Signal-To-Noise Delay Functions:

40	Automatic selection
41	200 mS delay
42	400 mS delay
43	600 mS delay
44	800 mS delay

TABLE 3-6. CONTINUED.

Signal-To-Noise Delay Functions Continued:	
45	1000 mS delay
46	1200 mS delay
47	1400 mS delay
48	1600 mS delay
49	1800 mS delay
Frequency Sweep Resolution Functions:	
50	Variable linear frequency sweep, Frequency Step value determines resolution
51	16 step logarithmic frequency sweep
52	32 step logarithmic frequency sweep
53	64 step logarithmic frequency sweep
54	128 step logarithmic frequency sweep
55	256 step logarithmic frequency sweep
56	512 step logarithmic frequency sweep
57	1024 step logarithmic frequency sweep
58	2048 step logarithmic frequency sweep
59	4096 step logarithmic frequency sweep
Sweep Settling Time Functions:	
60	Rapid Source Sweep (disable Analyzer)
61	1 Analyzer measurement
62	2 Analyzer measurements
63	3 Analyzer measurements
64	4 Analyzer measurements
65	5 Analyzer measurements
66	6 Analyzer measurements
67	7 Analyzer measurements
68	8 Analyzer measurements
69	9 Analyzer measurements
AC Detector Selection Functions:	
70	rms detector enabled
71	Average detector enabled
dBV/dBm Display Mode Selection Functions:	
80	dBV display mode referenced to 1.000 V
81	dBm display mode referenced to 1 mW, 50 ohms
82	dBm display mode referenced to 1 mW, 75 ohms
83	dBm display mode referenced to 1 mW, 150 ohms
84	dBm display mode referenced to 1 mW, 300 ohms
85	dBm display mode referenced to 1 mW, 600 ohms
86	dBm display mode referenced to 1 mW, 900 ohms

TABLE 3-7. OPTION SWITCH A4S1.

1 2 3 4 5 6 7 8	1 = OPEN 0 = CLOSED X = IRRELEVANT	
Normal Setting:		
0 0 0 0 0 0 0 0		
EOS Character Selection:		
0 0 X X X X X X	Listen: LF or CR LF	Talk: CR LF
1 0 X X X X X X	Listen: CR	Talk: CR LF
0 1 X X X X X X	Listen: CR	Talk: CR
1 1 X X X X X X	Listen: CR	Talk: LF
PEN Status Control:		
X X 0 X X X X X	Pen-up is active low	
X X 1 X X X X X	Pen-up is active high	
SPCL Function Disable:		
X X X 0 X X X X	Enable SPCL Functions 20 through 39	
X X X 1 X X X X	Disable SPCL Functions 20 through 39	
Auto Recall Enable:		
X X X X 0 X X X	Disable Program Auto-recall	
X X X X 1 X X X	Enable Program Auto-recall	
SRQ Enable:		
X X X X X 0 X X	Disable SRQ	
X X X X X 1 X X	Enable SRQ	
Test Mode Enable:		
X X X X X X 0 0	Normal Operation	
X X X X X X 0 1	Lamp Test	
X X X X X X 1 0	Filter Option Entry Mode	
X X X X X X 1 1	Reference Test	

3-85. Option Switch, A4S1, Operation.
Several of the Model 1120 operating features are internally programmable by setting bit switch A4S1. Gaining access to the switch requires that the cover be removed. Some of the Option switch functions can be altered using the Special Functions 0 through 9. The Option switch consists of eight separate switches which change the operating condition of the Audio Analyzer. Table 3-7 list the individual switches and their function.

3-86. Positions 1 and 2 of A4 are used for end-of-string (EOS) control for the IEEE-488 bus. End-or-Identify (EOI) is always recognized and asserted in addition to the EOS characters selected. Position 3 determines the Pen-up active state of the PEN output on the rear panel. Position 4 is

available to restrict the use of Special Functions 20 through 39. These Special Functions are associated with calibration and repair of the instrument. Position 5 determines the operation of the IEEE-488 SRQ function. When enabled the SRQ line will be set true if the SRQ key is depressed or if the instrument is in the remote condition and an error is generated. Position 6 determines the Program Auto Recall function. Normally the REC key must be depressed in order to recall any program location. When enabled the auto-recall function automatically performs the recall function when using the step keys to increment or decrement the program location function. However, entering a program location directly using the DATA ENTRY keypad requires that the REC key be depressed to execute the recall function. Position 7 and 8 are used for test modes and optional filter installation. When the lamp test is selected the display LEDs, display legends, and key LEDs with the exception of the Analyzer and Source function keys will be constantly illuminated. The remaining function keys will be illuminated in sequence.

3-87. Error Codes.
Error codes and descriptions for the Model 1120 are listed in Table 3-8. The error codes will appear in the SOURCE display window and will be returned by the talk-status (TS) IEEE-488 bus function if executed. The SRQ status byte will consist of the error code expressed in excess sixty-four. The status code 64 decimal means the SRQ was activated by the front panel SRQ key rather than an error.

3-88. REMOTE OPERATION.

3-89. Any front-panel operation of the instrument with the exception of the POWER ON/OFF switch and the Address function can be remotely controlled under direction of an IEEE-488 interface controller.

3-90. Setting the Bus Address.
To set the IEEE-488 bus address (MLTA), depress the ADRS key, enter the address number by means of the DATA ENTRY keypad and use the ENTER key to complete the entry. The address may be any decimal number from 0 to 30, inclusive. A secondary address is not implemented.

3-91. Entering the Remote Mode.
The instrument is put in the remote mode by addressing it as a listener with remote enable (REN) true. In the remote state the keyboard is disabled, except for the LCL/INIT key and the POWER ON/OFF switch, and the REM status annunciator is illuminated.

3-92. Returning to Local Mode.
The instrument may be returned to the local mode as follows:

a. The LCL/INIT key is depressed, provided local lockout (LLO) is not active.
b. The go-to-local (GTL) bus command is sent.
c. Remote enable (REN) is set false.

TABLE 3-8. ERROR CODES.

Error Code	Description
01	Source Frequency entry out of range
02	Frequency Step entry out of range
03	Source Level entry out of range
04	Level Step entry out of range
05	Illegal Special function entry
06	Sweep Start entry out of range
07	Sweep Stop entry out of range
08	Low plot limit entry out of range
09	High Plot limit entry out of range
10	Bus Address entry out of range
11	Store/Recall error: attempting to Recall an erased program location or Store in read-only location #99
12	Analyzer Frequency entry error: Attempting to set an illegal input voltage range or any frequency entry
13	Analyzer Level entry error: Attempting to set an illegal input voltage range
14	Analyzer Distortion entry error: Attempting to set an illegal input voltage range, reference frequency, or distortion range
15	Analyzer SINAD entry error: Attempting to set an illegal input voltage range or SINAD range
17	Ratio error: attempting to enter an Analyzer setting while in the Ratio mode
18	Ratio error: Ratio display overrange
19	Ratio error: Unable to enter Ratio mode while displaying notch tune frequency
20	Illegal units for active function
21	Buffer overflow: Too many key entries for display or IEEE-488 buffer overflow
22	IEEE-488 Bus error: Non existent mnemonic
23	IEEE-488 Bus error: Illegal Learn string format
24	IEEE-488 Bus error: Illegal Burst string format
25	Sweep error: Start and Stop units do not agree
26	Sweep error: High and Low values are equal or Start and Stop values are equal
30-35	Hardware error: Source frequency lock
40	Auto cal error: post notch RMS detector
41	Auto cal error: post notch average detector
42	Auto cal error: input RMS detector
43	Auto cal error: DC detector full scale
45	Auto cal error: Option filter # 1
46	Auto cal error: DC detector offset
47	Auto cal error: Option filter # 2

NOTE

The instrument must be placed in the remote mode for it to store and respond to data messages.

3-93. Triggered Operation.
In the remote mode the instrument can be operated in the "immediate" mode (mnemonic IM), or in the wait-for-trigger mode (WT). The immediate mode is the default condition and results in the immediate response to mnemonic commands and settings. The wait-for-trigger mode causes the execution of commands and settings to be deferred until a trigger is received. This aids in synchronizing the instrument's state changes to other system components. The wait-for-trigger mode is set when the WT mnemonic is encountered in the input string. From that point on execution is delayed. No change will occur until one of the following events is encountered:

a. "Group-execute-trigger" (GET) is received.
b. The mnemonic TR (trigger) is interpreted.
c. Any mnemonic following IM (immediate) is interpreted.

NOTE

Event (c), above, or go-to-local terminates the wait-for-trigger mode and restores the immediate mode. The wait-for-trigger mode is not active in local operation.

3-94. Talk Operation.
The instrument may be addressed as a talker without regard for remote/local mode. When the talker state is set by the bus controller, the instrument sends a character string which is determined by the current talk mode. One of six different talk modes is selected by sending the appropriate mnemonic with the Audio Analyzer addressed as a listener. The selected mode will remain in effect until changed.

3-95. Talk Status (TS) Mode.
In the TS mode the error code status of the instrument is returned as a number. Normal status returns a 0 code otherwise the error number is returned. The TS mode will automatically clear the error after the status is reported. The TS mode is the default talk mode after initialization of the instrument.

3-96. Talk Value (TV) Mode.
In the TV mode The argument of the active function designated by the KYBD annunciator is returned as a number. All values returned are in basic units such as: Hz, V, %, dB, etc.

3-97. Talk Program (TP) Mode.
In the TP mode a 10 digit number is returned that uniquely identifies the firmware and installed optional filters. A radix separates the firmware date code and the optional filter identification number. The 4 digit code to the right of the radix will correspond to codes listed in Table 5-2.

3-98. Talk Function (TF) Mode.
In the TF mode a string of up to 17 ASCII characters will be returned which identifies the

state of all active functions. The bit assignments are arranged to allow for string or byte oriented decoding. The various characters are listed in Table 3-10.

3-99. Talk Learn (TL) Mode.
In the TL mode a compressed parameter string of 143 ASCII characters, the last of which is an ASCII ($), is returned. This string can be sent back to the instrument to restore the exact state of all functions and settings which defined it, but it must be sent as a complete string without alteration. When the ($) character is encountered in the input buffer, the learn mode is automatically activated. While this form provides a compact and fast method to save and restore all settings, it bypasses much of the error control and therefore must be used with caution.

3-100. Talk Burst (TB) Mode.
In the TB mode a compressed parameter string of 21 ASCII characters, the last of which is an ASCII (&), is returned. This string can be sent back to the instrument to restore the exact state of the Source frequency and level functions and settings which defined it, but it must be sent as a complete string without alteration. When the (&) character is encountered in the input buffer, the burst mode is automatically activated. The TB mode provides the fastest form of setting Source frequency and level parameters where high speed programmability is required. While this form provides a compact and fast method to save and restore Source settings, it bypasses much of the error control and therefore must be used with caution.

3-101. End-Of-String (EOS) Control.
The instrument provides several end-of-string options to accommodate a wide variety of controllers. The instrument always terminates on EOI (end-or-identify) "true" and always sends EOI true with the last character of every string. In addition, CR, LF, or CRLF may be used. The use of CR and LF is selected by OPTION switch A4S1-1 and 2 and special functions 1 through 4. The EOI is not affected by A4S1 switch settings.

3-102. Using "Service Request" (SRQ).
The instrument may be configured to set SRQ true when it is in the remote mode and an error occurs. This is enabled by setting the OPTION switch A4S1-6 to the open position. The bus controller must be programmed to respond to SRQ true. In the usual case, the controller then executes a serial poll to determine which device caused SRQ to be true. If the instrument is the requesting device, it will respond to the serial poll with a single byte which expresses the error code number in excess 64. The serial poll will clear the SRQ line automatically. In small systems only one instrument may be capable of using SRQ. In this situation there is no need to execute a serial poll since the identity of the requesting device is known. The error code may be obtained directly form the talk status

(TS) mode. The SRQ line can then be cleared by sending the clear (CL) command.

3-103. Bus Command Responses.
IEEE-488 bus commands are sent by the controller to all devices on the bus (Universal Command Group) or to addressed devices only (Addressed Command Group). The response of the instrument is listed in Table 3-11.

3-104. Program Function Mnemonics.
Each front panel key is assigned a program mnemonic. Programming the mnemonic, followed by unit values, if appropriate, is analogous to manual front-panel operation. In addition, other program mnemonics are used for functions that are applicable only in remote operation. Table 3-9 lists all the program function mnemonics.

3-105. Number Formatting.
Number formatting rules are as follows:

a. Fixed or floating formats are accepted.
b. The optional + or - sign may precede the mantissa and/or the exponent.
c. The optional radix point may appear at any position within the mantissa. A radix point in the exponent is ignored.
d. The optional "E" for exponent may be upper or lower case.
e. ASCII characters having hexadecimal values of 0 to 23 and 26 to 2C are ignored.

3-106. Data String Format.
Data string formats are as follows:

a. The programming sequence is in natural order, that is, a function mnemonic is sent first followed by the argument, if appropriate.
b. ASCII characters having hexadecimal values of 0 to 23 and 26 to 2C are ignored. The ASCII (&), hexadecimal 25, and the ASCII ($), hexadecimal 24, are reserved. Lower case letters are automatically changed to upper case.
c. A primary function mnemonic sent without a following argument will make the specified function active.
d. The data string may not exceed 150 characters and may be terminated with LF, CR, and/or EOI.
e. Interpretation of the data string does not begin until termination occurs.
f. If units are unspecified for any argument, default units are automatically appended. The functions SPCL and PRGM always use default units.
g. If a units mnemonic is sent without a corresponding argument, the display will reflect the change provided that:

1. The units are appropriate for the active function or an error will result.
2. The display is enabled.
3. The display can accommodate the rescaled number; otherwise no change will result.

3-107. Data String Errors. Errors are detected during interpretation. The occurrence of an error will display the error code if the display is enabled, and will set SRQ true, if enabled. The error and SRQ can be cleared by a serial poll, a status request (TS), or a clear error instruction (CL). All errors cause previous valid parameters to be restored. No new input can be processed until an existing error is cleared.

3-108. Data String Examples. The following are examples of typical programming strings in HP BASIC:

a. OUTPUT 715; "SF 1.234 KH"
b. OUTPUT 715; "SF1234"
   (HZ is optional)
c. OUTPUT 715; "SF1.234E+3"
d. OUTPUT 715; "SF1234E-3KH"

3-109. Store and Recall Operation. Store and Recall operation may be used to advantage with a bus controller. The instrument provides either temporary or long-term storage for control strings. This can be used to minimize bus traffic by storing several control setups at initialization and recalling them when needed with a simple string statements, such as:

```
OUTPUT 715; "PG";23;"RE"
OUTPUT 715; "PGSURE"
OUTPUT 715; "PGSDRE"
```

Since few controllers have power fail protection, the data in the instrument's nonvolatile memory is the more secure.

TABLE 3-9. BUS MNEMONICS.

Mnemonic	Description
Source Function Group:	
SF	Source Frequency
FZ	Frequency Step size
SL	Source Level
LZ	Level Step size
SP	Special
Sweep Function Group:	
SW	Sweep Generator (Sweep on)
SG	Signal Generator (Sweep off)
XL	Start (X axis)
XR	Stop (X axis)
YL	Low (Y axis)
YH	High (Y axis)
PU	Pen Up
PD	Pen Down
Program Function Group:	
PG	Program location
RE	Recall program
ST	Store program
Analyzer Function Group:	
AF	Analyzer frequency
AL	Analyzer level
DN	Distortion
SI	SINAD
SN	Signal-to-noise
RA	Ratio mode enabled
RO	Ratio mode disabled
Filter Group:	
F0	Both optional filters #1 and #2 disabled
F1	Optional filter #1 enabled
F2	Optional filter #2 enabled
L0	All Low-pass filters disabled
L1	30 kHz Low-pass enabled
L2	80 kHz Low-pass enabled
L3	220 kHz Low-pass enabled
L4	DC Low-pass enabled (AC rejection)

TABLE 3-9. CONTINUED.

Mnemonic	Description
Float Group:	
SS	Single-ended Source Output
FS	Floating Source Output
SA	Single-ended Analyzer Input
FA	Floating Analyzer Input
Step Group:	
SU	Step up
SD	Step down
Units Group:	
HZ	Hertz
KH	Kilo Hertz
VO	Volt
MV	Millivolt
PC	Percent
DB	Decibel
CL	Clear
Trigger Group:	
IM	Immediate mode
WT	Wait-for-trigger mode
TR	Trigger
Talk Mode Group:	
TS	Talk status
TV	Talk value
TF	Talk function
TL	Talk learn string
TB	Talk burst string
TP	Talk program revision
Misc. Group:	
BL	Blank display
UD	Update display
EI	Enable SRQ interrupt
DI	Disable SRQ interrupt
CH	Source Oscillator Self Check
RM	rms Detector enabled
AV	Average Detector enabled

TABLE 3-10. TALK FUNCTION (TF) DECODING.

Talk Function String Format: **99,999,999,999,AAAAAAAAAA**

Active Function Assignments: <---

1 Source Frequency
2 Frequency Step
3 Source Level
4 Level Step
5 Special Function
6 Sweep Start
7 Sweep Stop
8 Low Plot Limit
9 High Plot Limit
10 Bus Address
11 Program Number
12 Analyzer Frequency
13 Analyzer Level
14 Distortion
15 SINAD
16 Signal-to-Noise ratio

Filter And Floating Bit Assignments: <-

MSB[8]	Float Analyzer Input
[7]	Optional Filter # 1
[6]	Float Source Output
[5]	Optional Filter # 2
[4]	DC low-pass filter
[3]	30 kHz low-pass filter
[2]	220 kHz low-pass filter
LSB[1]	80 kHz low-pass filter

Special Mode Bit Assignments: <------------

MSB[8]	Notch-tune Hold
[7]	Input Range Hold
[6]	Ignore Tune-status
[5]	Unlock Source
[4]	Not Used
[3]	Post Notch Range Hold
[2]	Slow Detector
LSB[1]	Not Used

Option Switch Bit Assignments: <---------------

MSB[8]	A4S1-8	Lamp Test
[7]	A4S1-7	Not Used
[6]	A4S1-6	Enable SRQ
[5]	A4S1-5	Enable Program Auto-recall
[4]	A4S1-1	End-of-String Character Select
[3]	A4S1-2	End-of-String Character Select
[2]	A4S1-3	Pen-up is Active High
LSB[1]	A4S1-4	Disable Special Functions 20-39

TABLE 3-10. CONTINUED.

```
Talk Function String Format:        99,999,999,999,AAAAAAAAAA
                                                            |
Alternate Operating Modes:  <-------------------------------'
[] Boxes currently displayed in Analyzer window
RA Ratio mode enabled
SW Sweep mode enabled
XC External counter reference enabled
AV Average detector enabled
RM rms detector enabled
```

TABLE 3-11. BUS COMMAND RESPONSES.

Commands	Instrument Response
Universal Command Group:	
Device Clear (DCL)	Clear errors
Local Lockout (LLO)	Disable LCL/INIT key
Serial Poll Enable (SPE)	Sets talk mode for poll response
Serial Poll Disable (SPD)	Restores talk mode before poll
Addressed Command Group:	
Selective Device Clear (SDC)	Same as device clear (DCL)
Go to Local (GTL)	Sets LOCAL mode
Group Execute Trigger (GET)	Triggers a measurement
All Others:	Ignored

SECTION IV
THEORY OF OPERATION

4-1. INTRODUCTION.

4-2. The Model 1120 is a versatile, solid-state, microprocessor controlled, audio analyzer that covers the frequency range of 10 Hz to 140 kHz. The instrument contains an independent audio source and analyzer for stimulus response testing with simultaneous display of source settings and analyzer measurements. Function parameters can be keyed in through a front panel keyboard or with remote programming using the IEEE-488 interface. Selected modes and values are displayed on an alphanumeric display and LED indicators. Input commands are processed by the internal microprocessor and control signals are developed to set up the internal circuits in accordance with the commands. The use of the microprocessor also enables the storage of up to 99 complete sets of instrument setup data. Commonly used setups can be entered into non-volatile memory either through the keyboard or through the IEEE-488 interface; thereafter, the instrument can be set to any desired set of conditions in memory by keying in the code number assigned to the desired setup in storage.

4-3. FUNCTIONAL BLOCK DIAGRAM DESCRIPTION.

4-4. Control of the instrument operation is exercised by a microprocessor that executes a fixed program resident in read-only-memory (ROM). Timing of the microprocessor operations is controlled by a 5 MHz clock. A random-access-memory (RAM) provides storage capability for microprocessor data. To insure retention of data in storage, the non-volatile RAM is powered from an internal 3 volt lithium battery. The main power supply develops the operating power required by the instrument.

4-5. The microprocessor communicates with the internal circuits through a data bus and an address bus. Command information is entered into the microprocessor through the front panel keyboard or an IEEE-488 interface. DIP switches are provided for option and test purposes. Input data selection is displayed by means of a digital readout and LED indicators. The microprocessor stores and processes input data, and generates data and address information to cause execution of command functions.

4-6. The audio input signal is first applied to a pair of differential attenuators followed by an instrumentation amplifier. The combination of amplification and attenuation normalizes a 300 mV to 300 V input level range to a range of less than 1.2 to 3 volts. The DC component of the input signal is detected after the amplifier, filtered, and measured with one channel of

the analog-to-digital converter (A/D) for the DC level measurement mode.

4-7. The AC component of the input signal is AC coupled and amplified further by factors of either 1, 2, or 5. A squaring circuit is used to convert the AC waveform to a TTL compatible squrewave which is used for the frequency measurement mode. The rms level of the AC waveform is converted to DC and measured with another channel of the A/D converter. The level measurement at this stage is used to autorange the input attenuators and amplifiers and is also used in the calculation of the distortion and SINAD measurements. After the rms detector, connectors are provided for up to two optional filters which can be selected individually and inserted into the signal path.

4-8. A programmable notch filter tuned to the fundamental frequency is inserted into the signal path in the distortion and SINAD measurement modes. The notch filter is tuned by the microprocessor circuits based on a manually selected or measured fundamental frequency. An amplifier with gain factors of X1 or X10 follows the notch filter. The notch filter and associated amplifier are bypassed in the frequency, AC and DC level, and signal-to-noise (S/N) measurement modes.

4-9. A programmable gain amplifier follows the notch filter circuits and provides amplification over a range of X1 to X100 in X1, X2, or X5 increments. The amplifier is used in conjunction with the input amplifier in the AC level and S/N measurement modes to provide extended range from 300 mV down to 3 mV full scale. In the distortion and SINAD measurement modes the amplifier is used in conjunction with the notch amplifier to boost harmonic and noise content in the pass band of the notch filter by up to 1000X. Low-pass filter selections are provided after the amplifier to attenuate out-of-band noise and preserve significant harmonic components. Following the low-pass filters are two level detectors. The rms or average (rms calibrated) level of the AC waveform is converted to DC and measured with another channel of the A/D converter. The level measurement at this stage is used to autorange the post-notch detector amplifiers and is also used in the AC level, distortion, SINAD and S/N measurement modes. The signal presented to the AC detectors is buffered and presented at the rear panel MONITOR output for external analysis.

4-10. The audio output signal is generated by a low distortion oscillator design which tunes from 10 Hz to 140 kHz. Microprocessor controlled coarse and fine tuning precisely sets and maintains the source frequency. A peak detecting sampler is used in the automatic level control circuits (ALC) to maintain a constant amplitude at all frequency settings.

4-11. The output of the oscillator is applied to a programmable attenuator which adjusts output level in 1 mV increments over a 0.001 to 3.000 volt

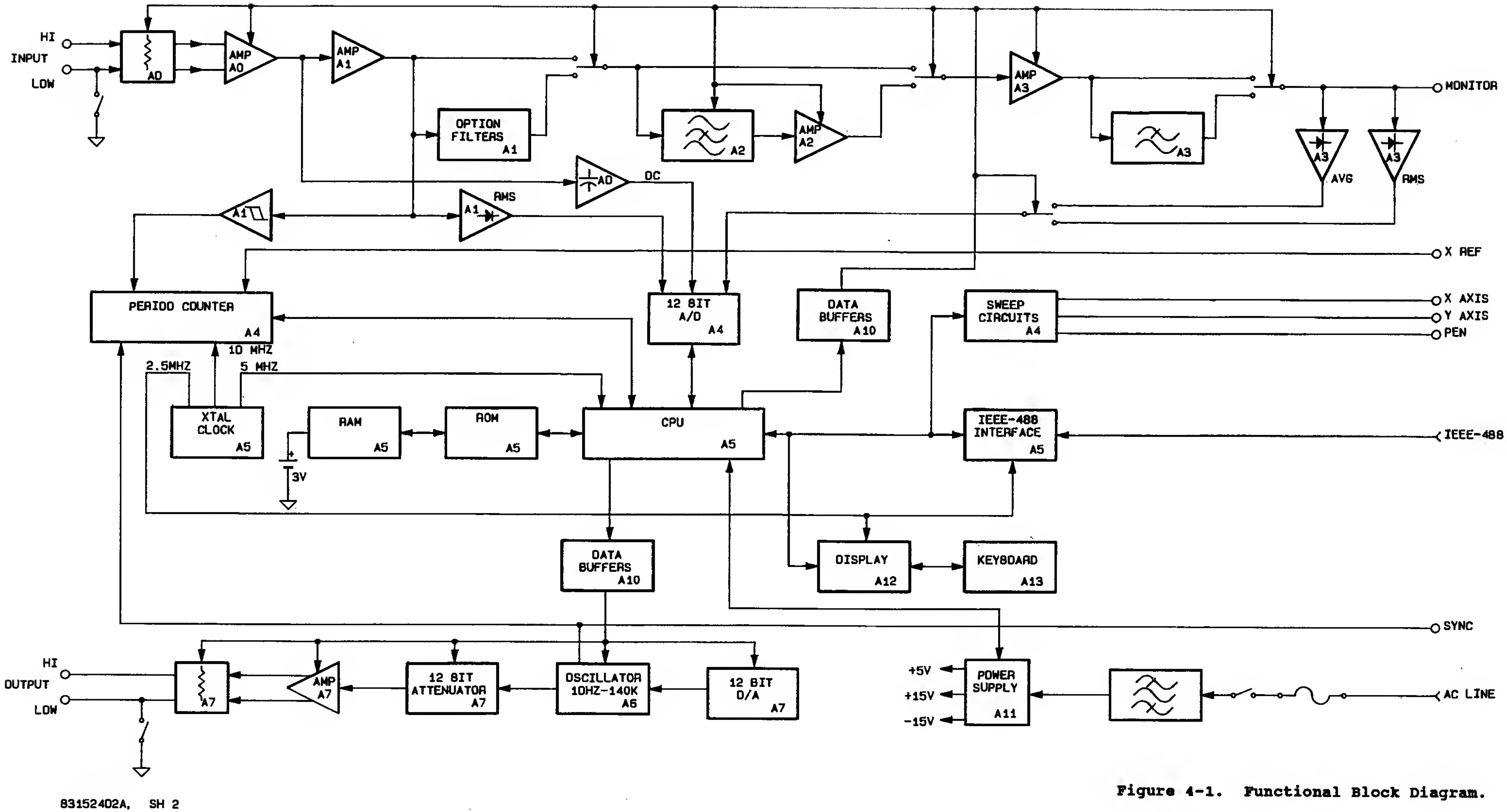

Figure 4-1. Functional Block Diagram.

range. The attenuator output is amplified and attenuated further to provide a total level range of 0.1 mV to 6.000 volts open circuit. A pseudo-floating amplifier is used to convert the single-ended source to a balanced-floating output.

4-12. The period counter circuits are shared by the source and analyzer. The actual source frequency is measured to enable fine tuning of the oscillator as part of a frequency lock loop. The analyzer frequency is measured for the frequency measurement mode and for automatic tuning of the notch filter.

4-13. The power supply circuits convert the incoming line voltage into regulated DC operating voltages to power the instrument circuitry.

4-14. DETAILED CIRCUIT DESCRIPTION.

4-15. A11 Power Supply Circuits.
The power supply provides the main power for the logic and analog circuits. Refer to Figure 4-2.

4-16. Line power is connected to transformer T1 via line filter FL1, fuse F1, and line voltage selector switch S2. Fl1 keeps internally generated RF signals from appearing on the power connecting cable thus preventing unwanted electromagnetic radiation. Line switch S2 alters the connections to the primary of T1 which allows the Model 1120 to be operated from line voltages from 100 to 240 volts.

4-17. One of the two secondary windings on T1 is connected through full-wave bridge CR1 to regulator U4. This regulator generates a +5 volt regulated voltage for the instrument logic and display circuits.

4-18. Capacitor C18 provides the essential energy storage which reduces the ripple voltage at the input of U4. C15 provides local bypassing of the regulator circuits and diodes CR5 and CR10 protect the integrated regulator from reverse power.

4-19. The other secondary winding of T1 is connected through full-wave bridge CR2 to regulators U5 and U6. These regulators are enclosed in feedback loops to improve regulation and increase the operating voltages from 5 to 15 volts. Capacitors C16 and C17 reduce input ripple voltage and CR6, CR11, CR8, and CR9 provide reverse voltage protection. Reference U3 is the primary voltage reference for the power supply. Precision resistors R10a, b, and e configure U2a for a gain of +1.5. This converts the +10.00 volt output of U5 to +15.00 volts. R10f and d configure U2b for a gain of -1 which inverts the +15.00 volt supply to -15.00 volts. Zener diodes CR3 and CR4 are required to insure proper startup of the supply, and are normally reverse biased when the supplies are operation properly. C13 and C14 provide local bypassing to maintain loop stability as the supply loading changes.

4-20. An additional 5 volt

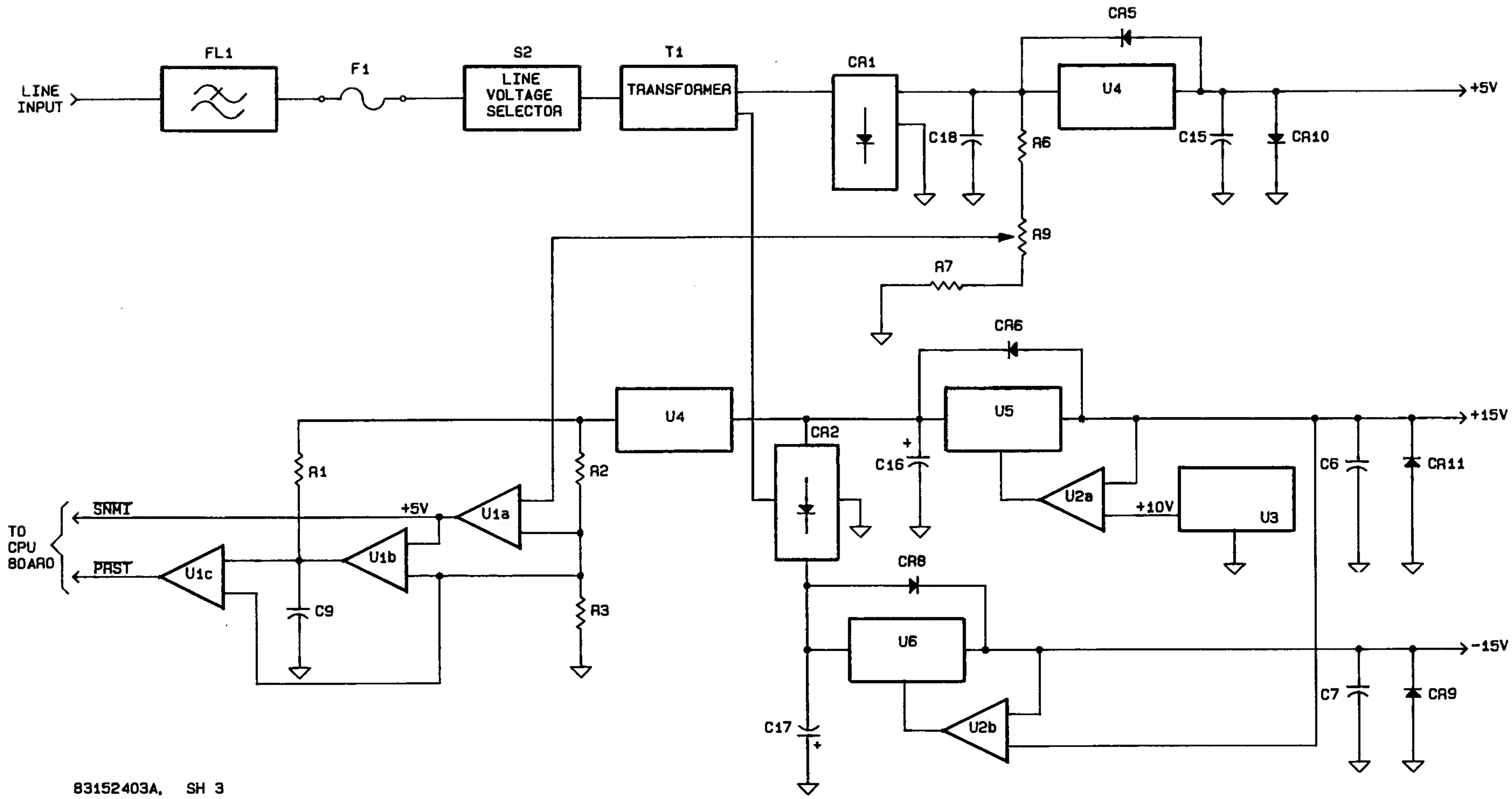

Figure 4-2. Power Supply Circuits.

regulator, U4, supplies power to the power-fail circuits. The operating voltage for U4 is the +15 volt supply input voltage which is about 20 volts at nominal line. This insures that the output of U4 will be maintained as long as possible when line voltage is removed.

4-21. The power-fail circuit operates to properly isolate the random access memory from logic circuitry when the line voltage drops or the instrument is switched off. Comparator U1a monitors the unregulated voltage which supplies the 5 volt logic supplies. Resistors R2 and R3 divide the power-fail circuit supply by two as a reference for U1a. If the power line voltage drops to about -11 % of nominal, U1a switches, pulling line SNMI low. This activates the power-fail sequence which interrupts the microprocessor and isolates the random access memory. U1b buffers the SNMI signal and drives a delay network, R1 and C9. When the open-collector output of U1b goes low, C9 is discharged quickly. This output is buffered by U1c to drive the PRST line which resets the CPU circuitry. When the output of U1b switches off, the PRST signal is delayed by the time required to charge C9 to one half of the power-fail supply voltage. This prevents multiple CPU resets as the supply voltage decays toward zero.

4-22. A10 Motherboard Circuits.
The motherboard circuitry provides the main interconnect for the operating circuits of the Model 1120. The motherboard circuits include the connectors for the plug-in boards, the power supply connectors and instrument data and address buffers for the source and analyzer analog sections.

4-23. Address decoding on the counter plug-in board generates the Master Analyzer Enable (MAE) signal which enables address decoder U1 and tri-state buffer U2. MAE is only active during instrument data write cycles to the analyzer circuits and inhibits RF generated noise caused by the many data transfers between the CPU and counter plug-in boards. The instrument data lines to the source and output plug-in boards are buffered in the same manner with decoder U4, buffer U5 and the Master Source Enable (MSE) signal from the counter plug-in board. Voltage regulator U3 supplies +5 volts for IC U1, U2, U4 and U5. The regulator input is supplied from the +15 volt regulated supply which is free from CPU related noise.

4-24. A5 CPU Circuits.
The CPU circuits are the central control circuits of the instrument. They receive input commands and data form the front panel keyboard or an IEEE-488 interface and configure the internal circuits of the instrument in accordance with the input commands and data. Storage facilities for up to 99 complete front panel setups are also provided. Refer to figure 4-3.

4-25. The Z-80 CPU, U7, executes a control program resident in read-only memory, (ROM) U14. Program variables and front panel setups are stored

in random-access memory, (RAM) U11. Local communications on the CPU board are via the high-speed data bus D0 through D7 and address bus A0 through A15. Memory address space partitioning is divided equally between RAM and ROM and is accomplished through inverter U1d. All other instrument peripherals are partitioned in the I/O address space which is accomplished with decoder U15. U12a, b, c, and d generate memory read and write signals and I/O read and write signals for qualifying data transfers between memory or I/O peripherals and the CPU.

4-26. The RAM is powered from a non-volatile power supply consisting of Q1, CR1 and BT1. If a power fault occurs, circuits in the power supply activate the SNMI line which in turn activates the NMI processor interrupt line. This causes the processor to stop the control program and execute a HALT instruction which sets the HALT pin low. This inhibits further write cycles to the RAM by setting a latch formed by U6c and d which disconnects the chip select (CS) line to the RAM using analog switch U5. Signal PRST is also set low shortly after SNMI is activated, causing the CPU to be reset to the program start. When proper operating voltage is restored, the SNMI line returns high releasing NMI and restoring the RAM CS connection. During the power down interval the RAM is powered by BT1.

4-27. Microprocessor timing is controlled by a 5 MHz clock which is derived from a 10 MHz TCXO, Y1, and flip-flop divider U13a. The clock signal is further divided by U13b to 2.5 MHz which is used by the IEEE-488 microcontroller, U16, and by the display circuits. The 10 MHz TCXO output is also buffered through U2a and is used for the internal timebase reference for the frequency counter circuits.

4-28. All IEEE-488 interface operations are conducted by U16 in conjunction with the microprocessor interrupt routines. These routines move data into and out of memory buffers as required in response to bus commands. U17 and U18 are buffer circuits which connect U16 to the IEEE-488 bus via J20. These buffers meet the electrical requirements of the IEEE-488.

4-29. Interrupt oriented control enables the CPU and control program to respond quickly to peripheral activity. When bus activity occurs, U16 sets the INT line via U1e, U2b and U1c. When a display/keyboard interrupt occurs the KEY INT line sets the microprocessor interrupt line through U2b and U1c. The microprocessor determines the source of the interrupt by reading the interrupt status buffer, U8, and services the requesting peripheral device.

4-30. The instrument bus interface adapter consists of U3, U9, R8, and R9. These tri-state buffers are normally in the high-impedance mode during all memory transfers and I/O data transfers occurring between the CPU and the display/keyboard circuits or

the IEEE-488 interface.

4-31. The display/keyboard bus interface adapter consists of U4 and U10. These tri-state buffers are only active during display/keyboard circuit transactions.

4-32. A12 Display And A13 Keyboard Circuits.
The display and keyboard circuits provide the operator interface to the Model 1120 circuits. Key closures are detected and sent to the microprocessor which interprets and modifies the display LEDs appropriately.

4-33. The software configurable display/keyboard microcontroller, U4, is programmed to operate 16 display digits. All of the seven segment displays are connected to a common cathode driver bus which is generated by U4 and buffered through U1 and current limiting resistors R1a through h. The LED anodes are individually connected to a one-of-sixteen decoder consisting of U5 and U6 and buffers U2 and U3. All segment decoding is done by the microprocessor so that no additional decoders are required.

4-34. All of the alphanumeric annunciators are static and latched by octal latches U8, U9 and U10. Resistors R4, R5 and R6 limit the current through the LEDs. Decoding for these latches is accomplished by U7.

4-35. The key LEDs are all static and latched by octal latches U12, U14 and U16. In addition some LEDs on the keyboard are decoded further by one-of-eight decoders U18 and U19. Resistors R7 through R10 limit the current through the keyboard LEDs.

4-36. Keyswitch decoding is accomplished by scanning the keyboard and detecting key closures. Microcontroller U4 controls the scanning of the keyboard through decoder U17 which generates the column strobes C0 through C7. Any key closure will convey the column strobe to one of eight row lines, R0 through R7, which are monitored by U4. Multiple key closures and key debouncing are handled by U4. When a keyswitch closures occurs a microprocessor interrupts is generated and processed as described in the CPU board section.

4-37. A4 Frequency Counter Circuits.
The counter circuits provide the frequency measurement functions of the Model 1120. Additionally, the analog-to-digital converter (A/D), the sweep output circuits, and the option switch are located on the counter plug-in board. Refer to Figure 4-4.

4-38. The 10 MHz internal frequency reference from the CPU board is connected to gate U3d. The other input of U3d is a signal derived from the external reference input. If an external reference signal is present, pin 6 of U2a will be a TTL compatible signal at the external reference frequency rate. The signal is inverted by U2b and detected by CR3, C25 and R4. When a signal is present the input of inverter U2c will be a TTL low level

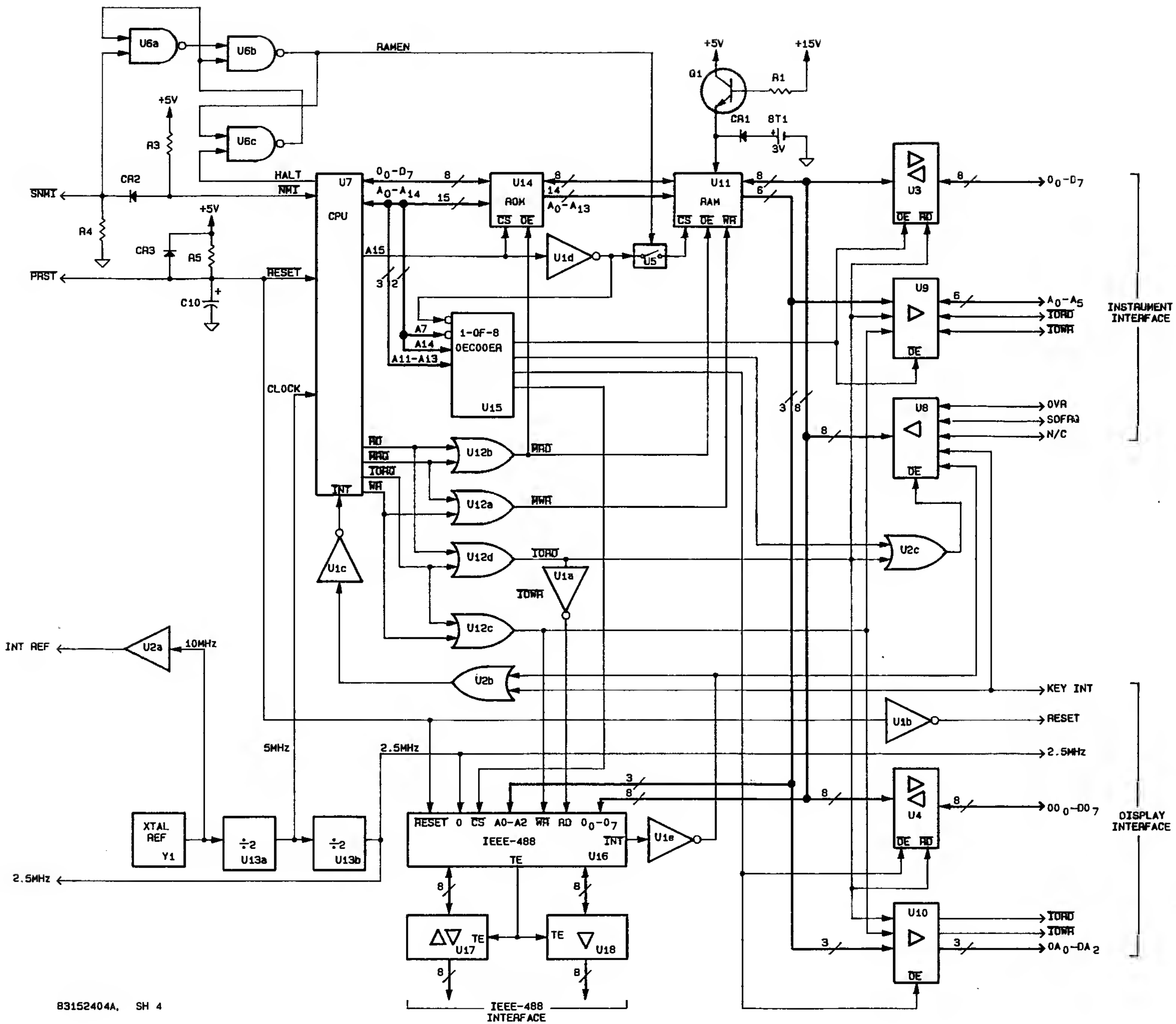

Figure 4-3. CPU Circuits.

which is the control to automatically switch to the external reference using U2d, U3a, U3b, and U3d. The output of U3b is the reference frequency for the counter circuits derived from either the internal or external source. DS2 will be illuminated when the external reference is active.

4-39. The analyzer frequency line ANFRQ is generated on the filter plug-in board and is applied to hysteresis amplifier U1a and associated components. U1a acts as a buffer between the analog and digital sections of the instrument and is insensitive to the noise which is present between the analog and digital grounds. The output of U1a is applied to the input multiplexer, U5, of the counter. U5 selects one of four inputs; source frequency, analyzer frequency, external reference, and internal reference, based on the state of control lines S0 and S1. The output of U5 is applied to a chain of dual decade dividers, U6, U7 and U8. These dividers are used for period selections and divide the selected input by factors of 1 to 1000000 in decade increments. All the divider output are presented to a second multiplexer, U9, which selects one of the six period divisions based on control lines T0, T1 and T2.

4-40. Dual flip-flop, U10, controls the arm and gate intervals. The output of U9 is inverted by U4b and applied to the clock input of U10a. The arm interval synchronizes the counter circuits to begin the gate interval on the next rising edge of the measurement signal. The ARM line is set low to clear flip-flop U10a. and, after being inverted by U4c, is applied to the master set (MS) lines of U6, U7 and U8. The MS sets all the divider output high which prepares the dividers to all start at count 0 with the next falling edge of the measurement signal. The rising edge of the ARM line clocks U10b, sets the U10b pin 9 high and illuminates DS4. When the falling edge of the measurement signal occurs, U10a is clocked and the gate interval begins when U10a pin 5 goes high. Simultaneously U10a pin 6 goes low which illuminates DS3 and clears the arm latch U10b. When U10b is cleared, DS4 is extinguished and U10b pin 9 is set low. The gate interval continues until U10a pin 5 is clocked low by the next rising edge at U10a pin 3. Gate U4a detects the end of the arm and gate intervals and indicates to the CPU that the count is complete. The counter will hold the count until the next arm interval is initiated. The output of U10a pin 5 goes to gate U3c which allows the reference to pass to the counter accumulator during the gate interval.

4-41. The gated reference is applied to to a 26 bit accumulator consisting of U12, U15 and U16. The accumulators cleared by a TTL low level from U13 pin 11. By detecting the most significant bit of the accumulator, U4d will prevent the accumulator from overflowing and illuminate DS5. The accumulator is read by the CPU through I/O devices U13-14.

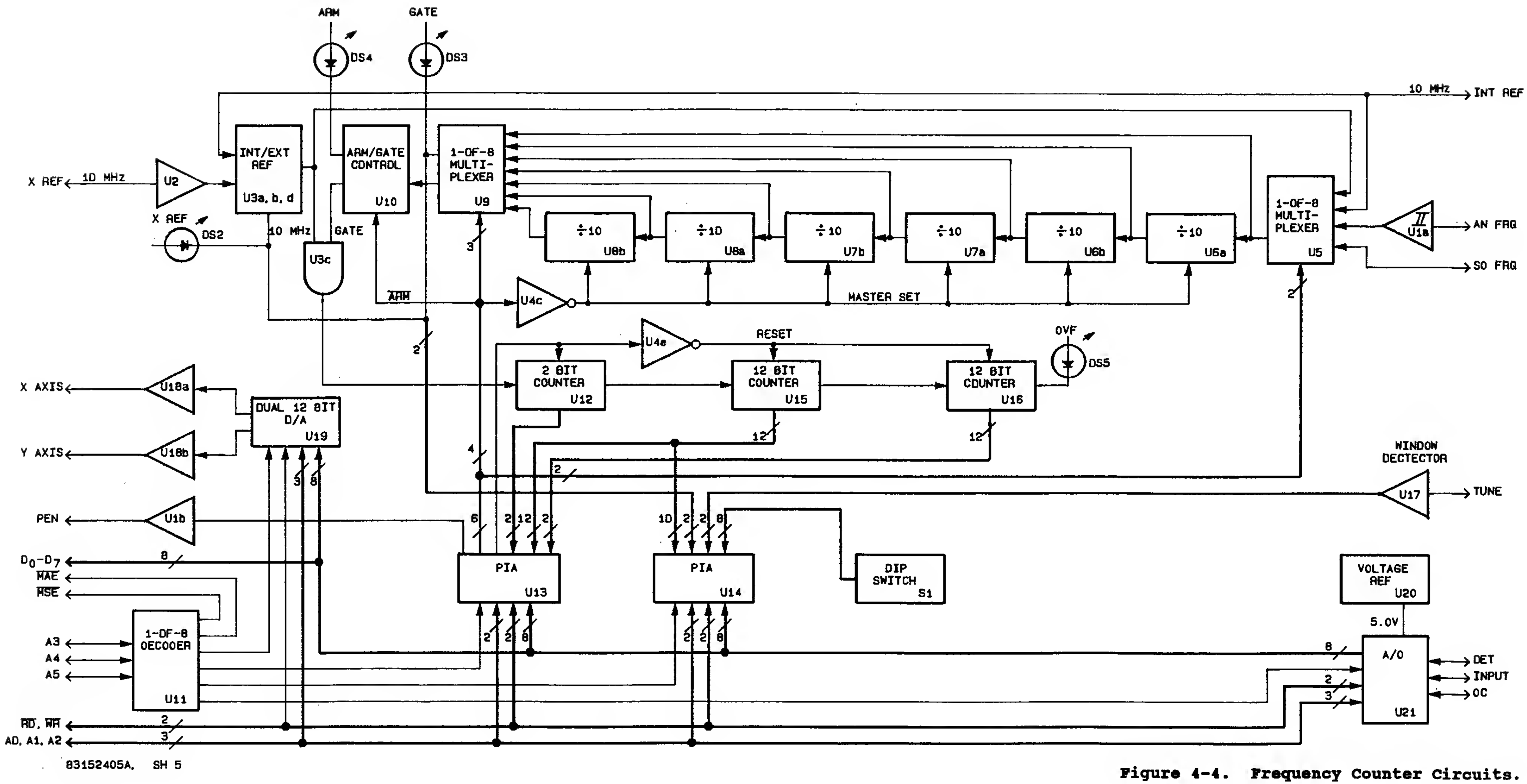

Figure 4-4. Frequency Counter Circuits.

4-42. The option dip switch is connected to one port of I/O device U14 along with lines indicating notch filter tuning status, external reference control and gate status. The TUNE line generated on the notch plug-in board is applied to a +- 10 volt window detector consisting of U17 and associated components. If the TUNE line exceeds +10 volts, U17a pin 1 will be pulled up to +5 volts by R21 and R22. If the TUNE line exceeds -10 volts, U17b pin 7 will be pulled up to +5 volts by R20 and R23.

4-43. Analog-to-digital converter (A/D), U21, converts one of four DC levels to a 12 bit binary representation where full scale is an input level of +5 volts. Reference U20 provides the 5 volt reference for the A/D converter. Auto zero capacitor C14 charges to the offset level before each A/D conversion. R28 provides a +2.5 volt offset to channel 3 of the A/D converter to allow for the bipolar input range of the DC measurement mode. A clock generating circuit consisting of R27, C15, CR10, CR11, and C16 sequences the auto-zero and conversion cycles of the A/D converter.

4-44. The sweep output circuits consist generate the X AXIS, Y AXIS, and PEN outputs. Buffer U1b generates the PEN output under command by the CPU through I/O device U13 pin 10. Reverse power protection is provided by R12, CR4 and CR5. The X AXIS and Y AXIS outputs are generated by dual 12 bit digital-to-analog converter (D/A), U19, and associated voltage amplifiers U18a and b. The -5 volt reference voltage for the D/A converter is zener regulated from the -15 volt supply by R24 and CR14 and filtered by C13. Reverse power protection is provided by R25, R26, and CR6 through CR9.

4-45. Address decoder U11 decodes the chip select lines for I/O devices U13 and U14, D/A converter U19, and A/D converter U21. MAE and MSE, the master analyzer and source enable commands used on the mother board, are also generated by U11.

4-46. A0 Input Circuits. The input circuits provide the attenuation and initial gain along with over voltage protection and AC/DC mode switching for the Model 1120. Refer to Figure 4-5.

4-47. The audio input signal is applied to the input plug-in board through low-pass filters L3, L4, C23, and C24 to reduce RF interference. Fuses, F1 and F2, prevent damage due to excessive input level. Float mode relay, K3, connects the LOW terminal to chassis ground in the non-floating mode. K3 is energized through transistor Q3 by data latched in U2 from the CPU circuits. AC coupling capacitors C1 and C2 are bypassed in the DC level mode by relays K4 and K5. Resistors R1 and R2 discharge C1 and C2 in the AC mode. Relays K4 and K5 are energized through transistor Q4 by data latched in U2 from the CPU circuits.

4-48. A 40 dB attenuator is formed by resistors R3 through R7, R15, and R16. This at-

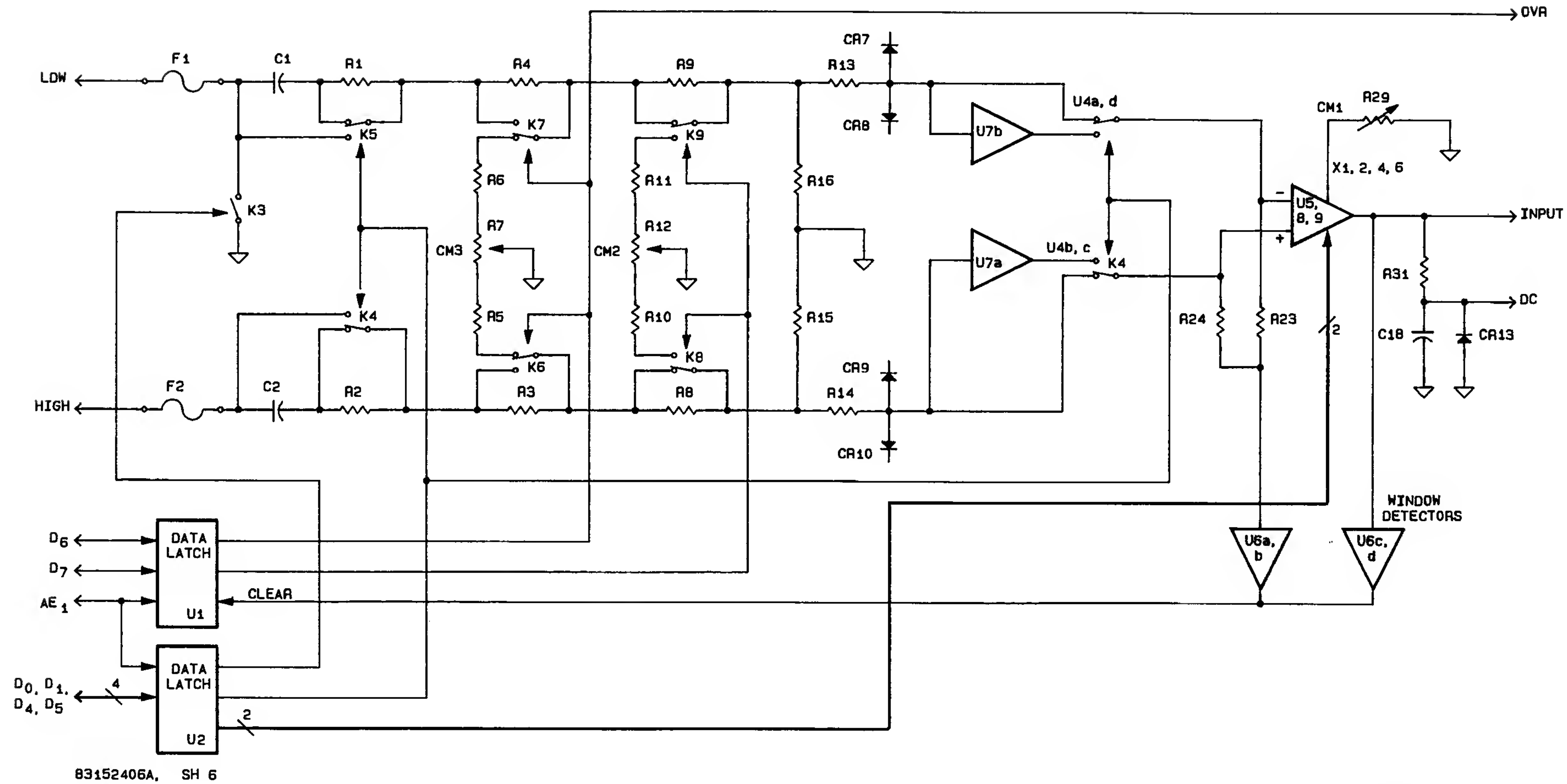

Figure 4-5. Input Circuits.

tenuator is engaged by relays K6 and K7 for level ranges above 30 volts. High frequency compensation is provided by C6 through C9 and C30 through C33. Common mode adjustment R7 adjusts the attenuation balance between the high and low inputs when the attenuator is engaged. Relays K6 and K7 are energized through transistor Q5 by data latched in U1 from the CPU circuits.

4-49. A 20 dB attenuator is formed by resistors R8 through R11, R15, and R16. This attenuator is engaged by relays K8 and K9 for level ranges between 3 and 30 volts. High frequency compensation is provided by C5, C10, C13, C14, C21, and C22. Common mode adjustment R12 adjusts the attenuation balance between the high and low inputs when the attenuator is engaged. Relays K8 and K9 are energized through transistor Q6 by data latched in U1 from the CPU circuits. Over voltage protection is provided by clamping diodes CR7 through CR10 and R13 and R14.

4-50. In the DC level mode, buffers U7a and U7b are switched in the signal path by analog switch U4. U7a and b are low DC offset devices which are necessary for DC level measurement accuracy. Analog switch U4 is wired in a DPDT form and is controlled by data latch, U2, which also energizes K4 and K5. Instrumentation amplifier consisting of U5, U8, U9, and associated components provides programmable gains of X1, X2, X4, and X6. Gain setting resistors R17 through R22 are configured by K1 and K2 for gain selections. Relays K1 and K2 are energized through Q1 and Q2 and resistors R43 and R44 by data latched in U2. High frequency compensation is provided by C3, C4, C25, C28 and C29. Amplifier U9 and resistors R25 through R29 form the differential to single-ended converter stage of the instrumentation amplifier. R29 enables the adjustment of the common mode rejection of the stage.

4-51. The common mode and differential signals are separately monitored by window detectors U6a through d for peak voltages exceeding +-10 volts. The common mode signal is formed by summing the outputs of U5 and U8 with resistors R23 and R24. The +- 10 volt window is formed by CR11, CR12, and R26. Any common mode or differential peak amplitude exceeding +-10 volts will cause the open-collector output of the detecting device to sink to -15 volts which is applied through R30 and R34 to the latch clear inputs of U1. Clearing latch U1 will engage the 40 dB attenuator and remove the overrange condition. The state of the 40 dB attenuator is monitored by the CPU circuits through the overrange status line, OVR, connected to U1 pin 9.

4-52. In the DC level measurement mode the DC level at the output of the instrumentation amplifier is filtered and clamped by R31, C18 and CR13 and measured by one channel of the A/D converter on the counter plug-in board.

4-53. A1 Filter Circuits.

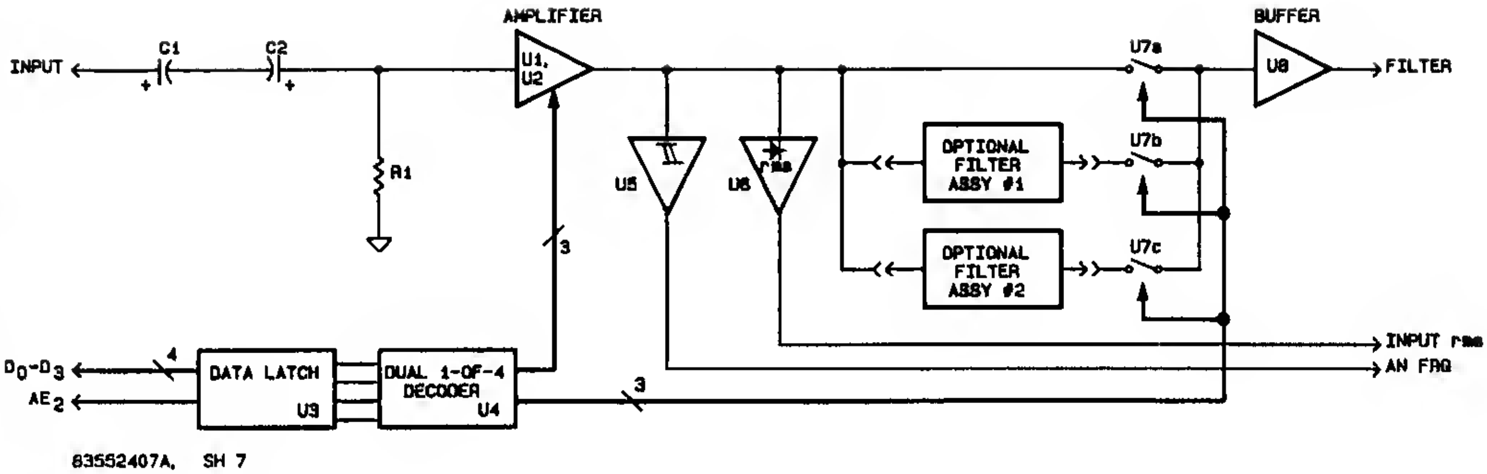

Figure 4-6. Filter Circuits.

The output of the Input circuits is further amplified by the filter plug-in board and the rms value of the AC signal is detected. The audio signal is also passed through a schmitt trigger circuit providing a TTL compatible square wave for the counter circuits. Up to two optional filter modules can be installed on the filter board and inserted into the signal path. Refer to Figure 4-6.

4-54. The signal from the input plug-in board is AC coupled to programmable gain amplifier U1 through C1, C2, and R1. Gain selections of X1, X2.5, and X5 are determined by R2, R3 and R4 and are selected by analog switch U2a, b and c. Gain selection data from the CPU board is latched in U3. Dual one-of-four decoder U4 decodes the data and enables one of the three gain selections.

4-55. The output of the amplifier U1 is applied a schmitt trigger circuit consisting of U5, R5, R6, R7 and CR1 through CR4. The output of U5 is a TTL compatible square wave which is measured by the counter circuits in the frequency measurement mode. A monolithic rms-to-DC converter, U6, converts the AC signal to a DC level representing the rms value of the waveform. Capacitor C7 is required by U6 for filter averaging. The output of U6 is measured by one channel of the A/D converter on the counter plug-in board. The signal level is measured at this stage in the analyzer circuits for distortion and SINAD measurement calculation and for autoranging the input attenuators and amplifiers.

4-56. Analog switches U7a, b, and d and buffer U8 are used to bypass or select one of two optional filter modules when installed. Filter selection data from the CPU circuits is latched in U3 and decoded by U4.

4-57. A2 Notch Filter Circuits.

The notch filter is an automatically tuned and balanced state-variable notch filter. The filter is inserted into the signal path to remove the fundamental frequency component and pass harmonics and noise for the distortion and SINAD measurement modes. Refer to Figure 4-7.

4-58. The notch filter consists of a state-variable band-pass filter and a balance amplifier, U3a. In operation the band-pass filter is tuned to the fundamental frequency measured by the counter circuits. The output of the band-pass filter is then subtracted from the input signal, leaving only the harmonic and noise components of the input signal. Fine adjustment of the notch center frequency and the amplitude of the band-pass output is accomplished by two control loops which operate to reduce the in-phase and quadrature components of the fundamental signal at the output of the balance amplifier.

4-59. The individual integrators in the filter are identical, so only one will be described in detail. The output from summing amplifier U1a

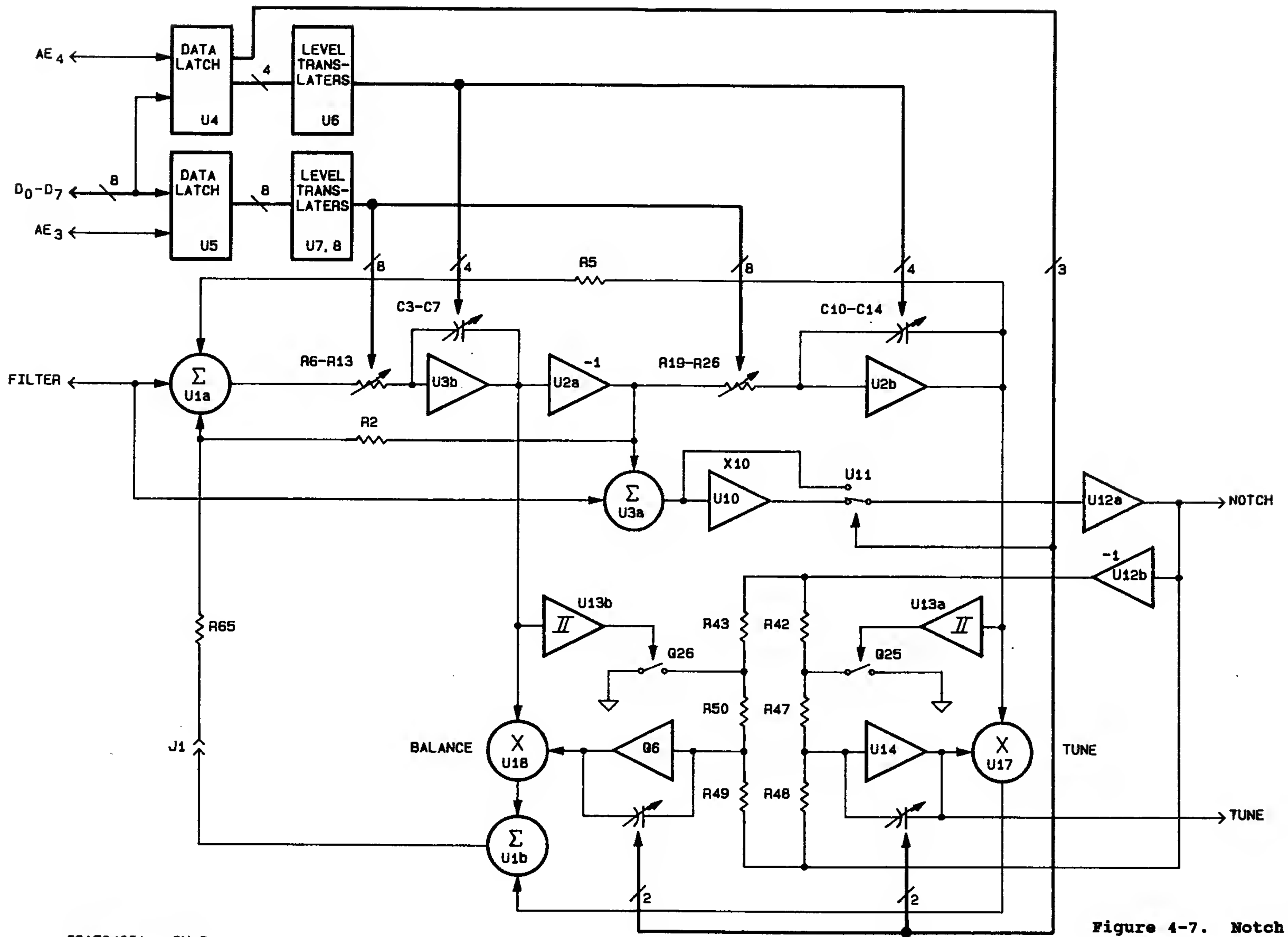

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Figure 4-7. Notch Filter Circuits.

is applied to a series of eight resistors. The values of these resistors, R6 through R13, are chosen in a binary series to operate as a discrete 8 bit D/A converter. These resistors are selected for frequency tuning within a selected frequency band by FET switches Q1 through Q8. Capacitors C3 through C7 are selected by FET witches Q9 through Q12 for integrator tuning over five frequency bands. Integrating amplifier U3b completes the integrator (TP2). Coarse tuning of the filter is provided by the selection of resistor and capacitor combinations by the control program. Data from the control program is latched in data latches U4 and U5. The 12 comparators contained in U6, U7, and U8 and associated pull-up resistors R29, and R30 act as level translators to convey the latched TTL data to gate drive levels necessary to operate the FET switches.

4-60. The band-pass filter output is generated at the output of inverting amplifier U2a (TP3). Balance amplifier U3a subtracts the band-pass output from the filter input signal forming a notch filter response. The output of the balance amplifier is further amplified with a gain of 10 by U10 and associated circuits. Analog switch U11a and b in conjunction with buffer U12a select the gain depending on range information from the control program. The output of U12a (TP10) is further processed by the detector circuits and used in the distortion and SINAD measurement modes.

4-61. The balance and tuning of the filter is controlled by synchronously detecting and reducing the in-phase and quadrature components of the fundamental at the output of U12a. comparators U13a and b detect the in-phase (TP2) and quadrature (TP5) signals in the band-pass filter and generate gate switching levels for chopper FETs Q25 and Q26. Amplifier U12b inverts the output of U12a and provides an out-of-phase signal to be used in generating full-wave rectified signals for the tune and balance integrators. The rectifier operates as follows: During the time that switches Q25 and Q26 are shorted to ground a current flows in resistors R48 and R49 to the integrators. When Q25 and Q26 are open, twice as much current at the opposite phase flows through resistors R42, R47 (TP6), R43, and R50 (TP8). Since the currents are out of phase the net current flow is the same and in the same direction providing a full-wave rectified currents to the integrators. Integrating amplifiers U14 and U16 generate error voltages in proportion to any in-phase or quadrature error currents. The integrator time constants are selected by analog switch U15 and capacitors C27 through C30 to allow optimum tracking dynamics across the tuning range of the filter. The tune and balance error voltages are applied to four-quadrant multipliers U17 and U18. The current outputs through pin 4 of each multiplier is summed together and amplified by U1b. The output of U1b is the product of the tune and balance error voltages and the in-phase and quadrature.

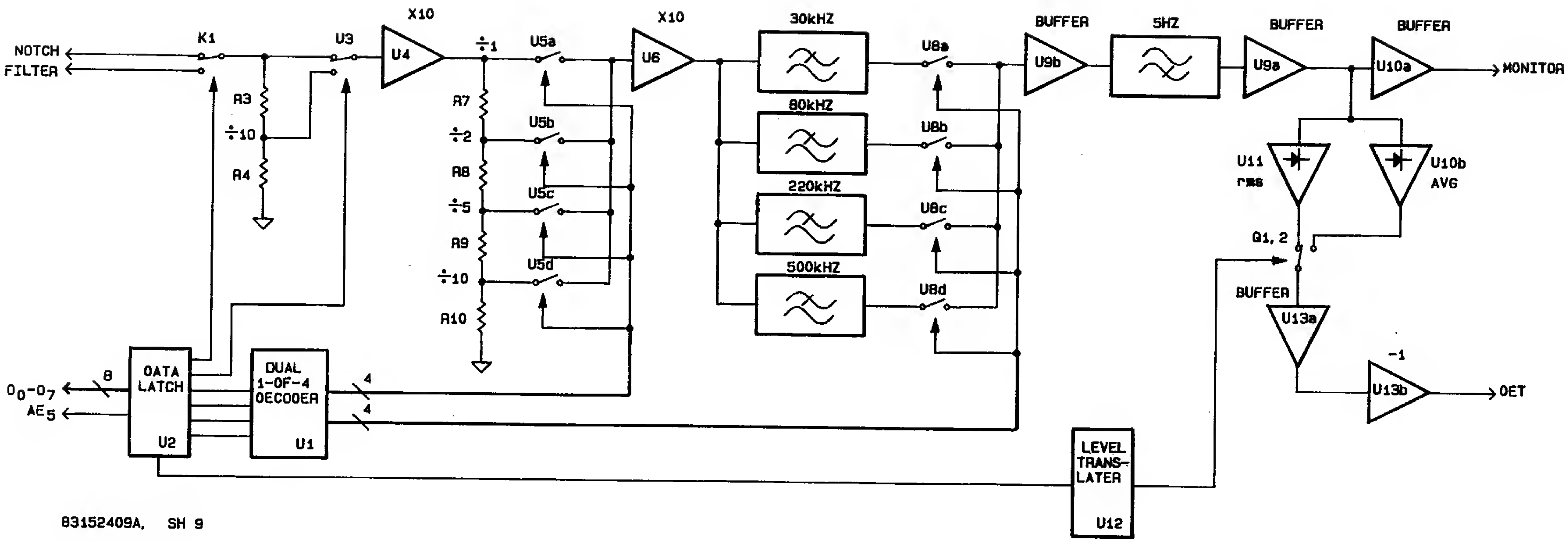


Figure 4-8. Detector Circuits.

signals which are summed back into the filter through U1a to cancel tuning and balance errors. The control loops can be disabled to aid in troubleshooting the notch filter circuits by removing jumper J1.

4-62. A tune status output signal is generated by tune integrator U14 (TP11). A window detector on the counter plug-in board monitors the tune status to determine if the notch filter is properly tuned. Tune and balance adjustments R57 and R58 are adjusted to null out any error voltages in the control loops which would limit the effective depth of the notch filter.

4-63. A3 Detector Circuits. The detector circuits provide the post notch gain, low-pass filters and the rms and average detectors for the Model 1120. Refer to Figure 4-8.

4-64. Relay K1 is selected by the control program to insert the notch filter into the signal path in the distortion and SINAD measurement modes. In all other modes the filter is bypassed. Analog switches U3a and b with resistors R3 and R4 form a programmable attenuator with 0 dB or 20 dB of attenuation. This attenuator is followed by amplifier U4 having a gain of 20 dB determined by R5 and R6. The attenuator and amplifier combination form a programmable 0 dB or 20 dB gain stage. The amplifier is actively clamped by diodes CR2 and CR3 to the bipolar voltage reference formed by CR6, CR7, and R13. All output swings of amplifier U4 will be limited to less than +- 10 volts peak preventing the stage from saturating and enabling fast recovery after transients. The output of U4 (TP1) is AC coupled to another programmable attenuator consisting of analog switch U5a through d and R7 through R10. Amplifier U7 is an identical clamped gain stage as U4 with a gain of 20 dB. The combination of the attenuator and amplifier form a programmable gain stage with gain selections of 1X, 2X, 5X, and 10X.

4-64. Following the gain stages (TP2) is the low-pass filter selections. Analog switch U8 selects the various filter values for the 30 kHz, 80 kHz, 220 kHz or >500 kHz low-pass filters. Unity gain buffer U9b completes the selected filter (TP3).

4-65. Amplifier U9a and associated components form a 5 Hz high-pass filter which determines the low frequency bandwidth of the Model 1120. Buffer amplifier U10a and CR8, CR9 and R27 present the detector output signal to the rear panel MONITOR output connector for external analysis (TP4).

4-66. The complete detector amplifier and attenuator chain is programmable for a gain change of 0 to 40 dB in 1X, 2X, or 5X increments. In the distortion and SINAD modes the 20 dB amplifier on the notch filter plug-in board increases the chain to a total combined gain of 60 dB. The programmable gain is required to maintain a constant level of between 1.2 and 3 volts at the rms and average detectors to preserve

the resolution and accuracy of the analyzer over a wide dynamic range. The rms detector consists of U11 and associated components. The output of the rms detector (TP5) is a DC level equal in amplitude to the rms value of the input signal. The average detector consists of U10b and associated components. U10b forms a full wave rectifier circuit and C32 filters the output to a DC level representing the average value of the input signal (TP6). FET switches Q1 and Q2 select one of the two detectors for measurement by one channel of the A/D converter on the counter plug-in board. Resistors R37 and R37 balance the gain of the average and rms detectors to be equal for a sine-wave input waveform. Inverting amplifier U13b presents a positive 0 to 3 volt level to the A/D converter (TP7).

4-67. Detector selection is controlled by the data latched in U2 by the control program. The TTL data from the latch is converted to gate drive levels for Q1 and Q2 by U12a and b and associated components. Gain, filter and input selection data is also latched in U2. Dual one-of-four decoder U6 decodes the latched data to analog switches U5 and U8.

4-68. A6 Source Circuits. The source oscillator is a digitally tuned, automatically leveled state-variable oscillator. The source circuits generate a sinusoidal audio waveform at a constant amplitude over a frequency range of 10 Hz to 140 kHz. Refer to Figure 4-9.

4-69. The source oscillator consists of a state-variable oscillator and a automatic level control (ALC) loop. In operation the oscillator is coarse tuned to the selected frequency and then the actual frequency is measured by the counter circuits and fine adjustments are made by the control program to achieve an accurate frequency.

4-70. Coarse frequency tuning is achieved by adjusting the time constant of the two integrators. The individual integrators are identical, so only one will be described in detail. The output from summing amplifier U12a is applied to a series of eight resistors. The values of these resistors, R49 through R56, are chosen in a binary series to operate as a discrete 8 bit D/A converter. These resistors are selected for frequency tuning within a selected frequency band by FET switches Q18 through Q25. Capacitors C18 through C22 are selected by FET switches Q14 through Q17 for integrator tuning over five frequency bands. Integrating amplifier U12b completes the integrator (TP*). Coarse tuning of the oscillator is provided by the selection of resistor and capacitor combinations by the control program. Data from the control program is latched in data latches U15 and U16. The 12 comparators contained in U13, U14, and U17 and associated pull-up resistors R61, R62, and R63 act as level translators to convey the latched TTL data to gate drive levels necessary to operate the FET switches.

4-71. The oscillator output is generated at the output of integrating amplifier U12b (TP*). A limiter circuit formed by CR11 through CR16 and R38 through R40 prevent overload transients in the output which may occur during frequency transitions.

4-72. The leveling and fine tuning of the oscillator is controlled by adjusting the in-phase and quadrature components of the source signal at the output of U12b. The ALC circuits sample the positive peak of the sine wave and compare the peak level to a voltage reference. The difference is sampled by an error integrator and applied to gain control circuits which work to reduce leveling errors by adjusting the feedback of the in-phase component.

4-73. A quadrature detector is formed by U1 and associated components. The output of U1 is a TTL compatible square wave used in the ALC loop to detect the peak of the source output waveform. The output of U1 is buffered by gate U6a and is present at the rear panel SYNC output connector. Diodes CR9 and CR10 and resistor R28 provide reverse voltage protection. The SOFRQ output is applied to the counter circuits to enable internal measurement of the actual source frequency.

4-74. The source output signal is AC coupled by C27 and R65 and applied to a track-and-hold circuit, U9. The quadrature detector generates the track and hold control signal which tracks the rise of the sinusoid and holds the peak value for 180 degrees. The output of U9 is sampled by U10 immediately following the start of the hold period. The hold period of U9 effectively extends the peak of the sinusoid to eliminate sampling aperture errors. The 30 uS sampler aperture is determined by one-shot U5a and timing network C5 and R7. The output of U10 is a DC level equal to the positive peak amplitude of the source output signal. Voltage reference U19 generates +5 volts which is applied to a voltage divider network formed by R2, R3, and R4. Oscillator calibration adjustment R2 allows fine adjustment of the source output level. The output of U10 is subtracted from the calibration reference by amplifier U2b and associated components forming an error voltage. Error integrator U3 is enabled by shunt chopper Q1 during the 30 uS sampling period. A level translator circuit consisting of U4 and associated components convert the TTL sampling signal to gate drive levels to control FET Q1. The output of the error integrator, U3, is amplified by U2a and applied to four-quadrant multiplier U8 to complete the ALC control loop. One-shot U5b and timing network R8 and C6 forms a start-up circuit which triggers after a 200 mS absence of the quadrature signal. When U5b triggers, U9 and U10 are set in track and sample modes to guarantee oscillation when the power is first applied and when there is no quadrature signal.

4-75. The fine tune and ALC error voltages are applied to four-quadrant multipliers U7 and U8. The current outputs

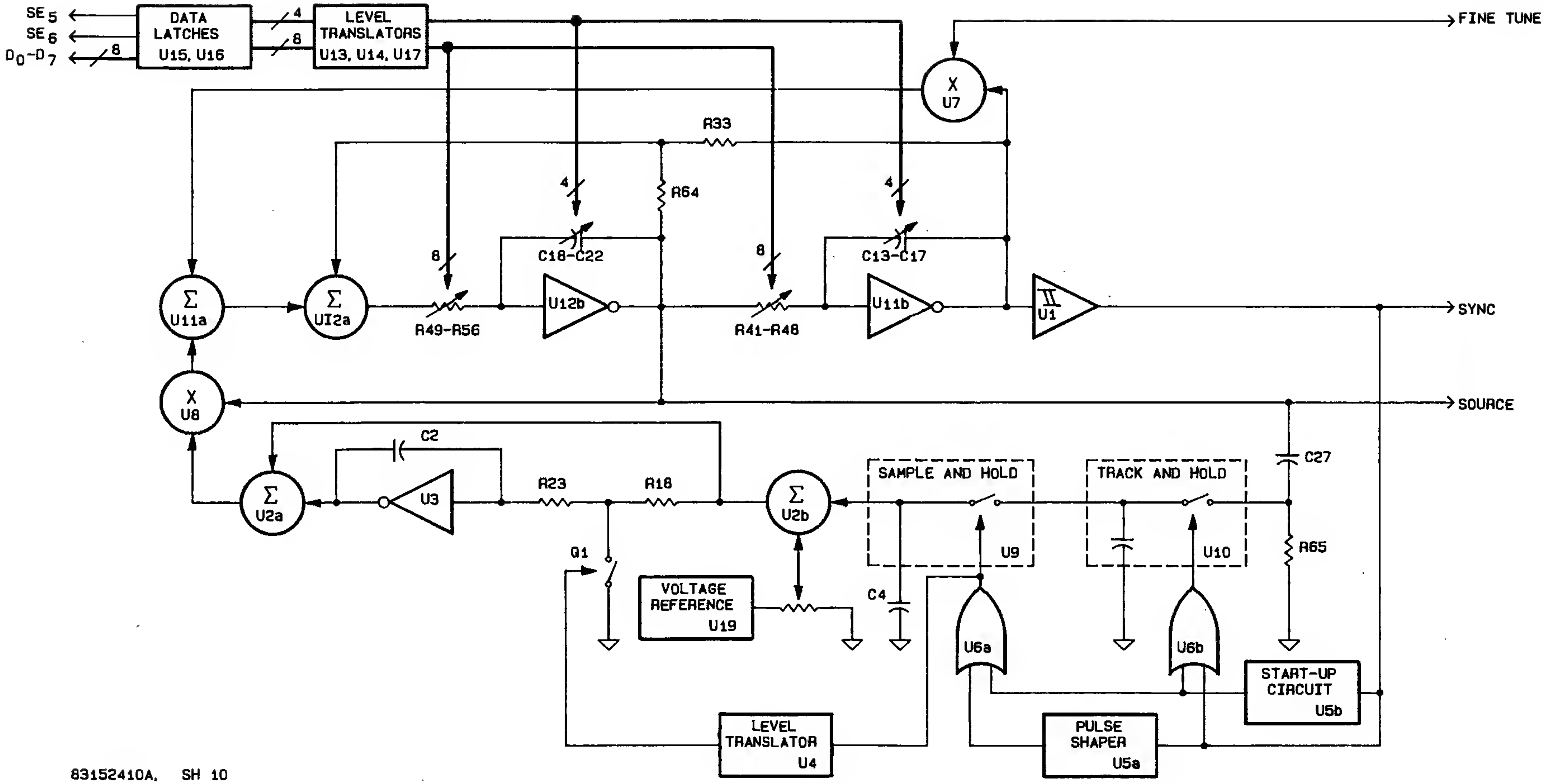


Figure 4-9. Source Circuits.

through pin 4 of each multiplier is summed together and amplified by U11a. The output of U11a is the product of the ALC error and fine tune voltages and the in-phase and quadrature signals which are summed back into the oscillator through U12a. The ALC control loop can be disabled to aid in troubleshooting the oscillator circuits by removing U8. In this design The ALC control loop operates to reduce oscillation, therefore, removing U8 causes the oscillator level to increase to the limit set by the limiter circuits controlling U12b. The oscillator and ALC circuits can then be investigated individually.

4-76. A7 Output Circuits. The output circuits consist of the floating power output amplifier, the variable gain and attenuation to cover a level range of 0.1 mV to 6 volts, and the programmable DC voltage used to fine tune the frequency of the source circuits. Refer to Figure 4-10.

4-77. The source oscillator output is applied to resistors R13 through R22. The values of these resistors are chosen in a binary series to operate as a discrete 12 bit D/A converter. These resisters are selected for level increments within the 6 volt, 3 volt, or 300 mV level range by FET switches Q3 through Q14. The three most significant bits are trimmed for maximum accuracy by resistor R15, R17, and R21. Data from the control program is latched in data latches U4 and U5. The 14 comparators contained in U6 through U9 and associated pull-up resistors R4, R5, and R6 act as level translators to convey the latched TTL data to gate drive levels necessary to operate the FET switches. Amplifier U10 is a programmable gain stage with gain selections of 1X or 2X. When FET switch Q16 is open, resistor R34 and FET Q17 configure the amplifier for a gain of 2 for the 3 to 6 volt range. When Q16 is closed R33 reduces the gain to 1 for the 3 volt and 300 mV level ranges. In the signal-to-noise measurement mode, Q15 is and C9 are used to squelch the source output during the noise measurement interval.

4-78. The output amplifier is formed by U11 and U12. High side amplifier, U11, is connected as an inverting stage while low side amplifier, U12, is non-inverting. The 600 ohm source output impedance is determined by the sum of R41 and R44. The combination of positive and negative feedback around the the output amplifiers yield a symmetrical differential output with high common mode rejection. The output amplifier circuits are protected against reverse power overload by clamping diodes CR3 through CR6, resistors R47 and R48, and fuses F1 and F2. Relay K3 provides a ground reference for the floating output circuits by connecting the LOW terminal through fuse F2 to chassis ground in the nonfloating mode. Relay K3 is energized through Q1 and R11 by data latched in U4. A 20 dB attenuator used on the 300 mV range is formed by R49, R51 and R52. Relays K1 and K2 are energized alternately by Q2 and Q18 to engage or bypass the at-

tenuator.

4-79. The fine tune voltage is generated by 12 bit D/A converter U1. A 10 volt reference for the D/A converter is provided by U3. Amplifier U2a provides a 0 to -10 volt output from the D/A converter while U2b and resistors R1, R2, and R3 generate a -6.7 to +13.4 volt output range to tune the source oscillator.

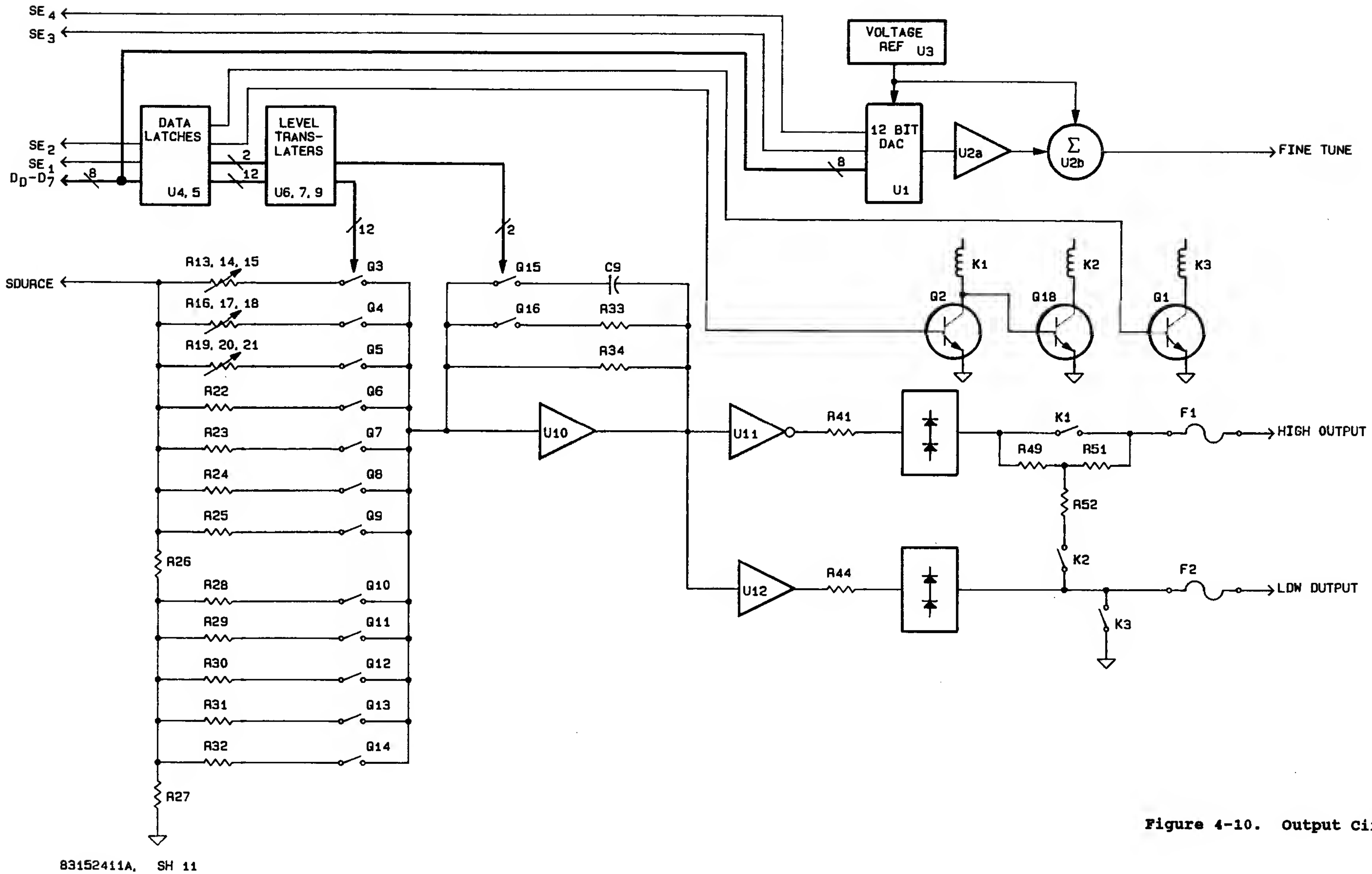


Figure 4-10. Output Circuits.

SECTION V
MAINTENANCE

5-1. INTRODUCTION.

5-2. This sections contains the safety requirements, required test equipment, and procedures for cleaning, removal and replacement, inspection, performance test, and adjustment for the Model 1120 Audio Analyzer.

5-3. SAFETY REQUIREMENTS.

5-4. Although this instrument has been designed in accordance with international safety standards, general safety precautions must be observed during all phases of operation, service and repair of the instrument. Failure to comply with the precautions listed in the Safety Summary at the front of this manual or with specific warnings given throughout this manual could result in serious injury or death. Service and adjustments should be performed only by qualified service personnel.

5-5. REQUIRED TEST EQUIPMENT.

5-6. Test equipment required for the performance tests and adjustments is listed in Table 5-1. Any equipment that satisfies the critical specifications in the table may be substituted for the recommended models. However, the performance tests are based on the assumption that the recommended test equipment is used.

5-7. CLEANING PROCEDURE.

5-8. Painted surfaces can be cleaned with a commercial, spray-type window cleaner or with a mild soap and water solution.

CAUTION

Avoid the use of chemical cleaning agents which might damage the plastics used in the instrument. Recommended cleaning agents are isopropyl alcohol, a solution of 1 part kelite and 20 parts water, or a solution of 1 % mild detergent and 99 % water.

5-9. REMOVAL AND REPLACEMENT.

5-10. Instrument covers. Remove the instrument covers as follows:

a. Disconnect the power cord and all signal cables from the instrument.

b. Remove the three screws located at the rear of the cover.

c. Slowly lift the cover up and to the rear.

d. Turn the unit over and remove the bottom cover in the same manner as the top cover was removed.

e. To replace the covers reverse the removal pro-procedure.

TABLE 5-1. RECOMMENDED TEST EQUIPMENT.

INSTRUMENT TYPE	CRITICAL SPECIFICATIONS	SUGGESTED MODEL
AC/DC Calibrator	Frequency Range: 10 Hz to 200 kHz Level Range: 1mV to 300 V Flatness: +- 0.3 %; 10 - 30 Hz +- 0.25 %; 30 Hz - 200 kHz AC Accuracy: +- 0.1 %; 50 Hz - 50 kHz DC Accuracy: +- 0.05 %	Fluke Model 5100B-03
Audio Oscillator	Frequency Range: 5 Hz to 500 kHz Level Range: 0 to 3 V rms Flatness: +- 0.3 dB	Tektronix Model SG502
Frequency Counter	Frequency Range: 10 Hz to 200 kHz Accuracy: 0.1 ppm	HP Model 5345A
Digital Voltmeter	AC Accuracy: +- 1.0 % Resolution : 1 uV; 0 to 200 mV 10 uV; 200 mV to 2 V 100 uV; 2 V to 20 V DC Accuracy: +- 0.2 %	Fluke Model 8840A-09
Wave Analyzer	Frequency Range: 20 Hz to 50 kHz Bandwidth: 10 Hz Display Range: > 70 dB	HP Model 3581A
Frequency Standard	Frequency: 10 MHz Level: TTL compatible Accuracy: 0.1 ppm	House Standard

TABLE 5-1. CONTINUED.

INSTRUMENT TYPE	CRITICAL SPECIFICATIONS	SUGGESTED MODEL
Variac/Line Monitor	20 % variation about 100, 120 or 240 volts	Powerstat Model 3PN116B
Balanced Cable	Two conductor shielded balanced line	Boonton 954021
Adapters (4 req.)	Single binding post to BNC (M)	Boonton 954018

5-11. Display/Keyboard Access. To gain access to the display and keyboard proceed as follows:

a. Remove the instrument covers as described in paragraph 5-10.

b. Remove the three screws that hold the top trim extrusion.

c. Remove the trim strip.

CAUTION

When removing the display window be careful not to scratch the inner surface of the window.

d. Remove the plastic display window.

e. Turn the instrument over and remove the three screws that hold the bottom trim extrusion.

f. Remove the trim strip.

g. Tilt the bottom of the front panel away from the instrument until all switches are clear. Pull the front panel up to clear the center trim extrusion for access.

h. To replace the display/keyboard reverse the removal procedure.

5-12. Plug-in Circuit Boards. Remove the plug-in circuit boards as follows:

a. Remove the instrument covers as described in paragraph 5-10.

b. Grasp the circuit board extractors, pull up, and slide the circuit board up and out of the instrument.

c. To replace the circuit board reverse the removal procedure.

5-13. Optional Filters. Install the optional filters as follows:

a. Remove the instrument top cover as described in paragraph 5-10.

b. Remove the Filter board (brown extractors). Refer to paragraph 5-12. Place the board on a flat working surface with the components up and the extractors at the top.

NOTE

There are two positions available for optional filters. These positions are located on the right and left-center part of the circuit board. The right position corresponds to optional filter # 2 which is activated by the rightmost optional filter key on the front panel and the left-center position corresponds to optional filter # 1 which is activated by the leftmost optional filter key. Either position will accommodate any of the available optional filters.

c. Install the optional filter in the desired position.

d. Replace the circuit board.

WARNING

There are voltages at various points in the instrument which can, if contacted, cause personal injury. Observe all safety precautions. Service and adjustments should be performed by trained service personnel only.

e. Connect power to the instrument and set the Power ON/OFF switch to ON.

f. Set the option switch A4S1-7 to the open position.

g. Depress the LCL/INIT key.

h. After the initialization sequence is complete, depress the SPCL key and for each filter installed enter the special option number listed in Table 5-2 that defines the filter type and the installation position.

i. Set the option switch A4S1-7 to the closed position.

j. Set the Power ON/OFF switch to OFF and disconnect all power to the instrument.

k. Replace the instrument top cover.

5-14. Firmware.
Remove the EPROM as follows:

a. Remove the instrument top cover as described in paragraph 5-10.

b. Remove the CPU board (green extractors). Refer to paragraph 5-12. Place the board on a flat working surface with the components up.

CAUTION

When removing and replacing an integrated circuit (IC) note the mark or notch used for pin number identification.

c. Locate EPROM A6U14. Remove

TABLE 5-2. OPTIONAL FILTERS.

FILTER TYPE	SPECIAL OPTION CODE		CALIBRATION SETTINGS	
	LEFT POS.	RIGHT POS.	FREQUENCY	LEVEL
NO FILTER	10	20	N/A	N/A
400 Hz	11	21	1000 Hz	3.000 V
CCITT	12	22	800 Hz	3.000 V
CCIR	13	23	6300 Hz	3.000 V
CCIR/ARM	14	24	6300 Hz	3.000 V
A WTNG	15	25	1000 Hz	3.000 V
B WTNG	16	26	1000 Hz	3.000 V
C WTNG	17	27	1000 Hz	3.000 V
AUDIO	18	28	1000 Hz	3.000 V
C-MESSAGE	19	29	1000 Hz	3.000 V

the IC with a straight pull away from the board.

d. Install the replacement IC.

e. Replace the circuit board.

WARNING

There are voltages at various points in the instrument which can, if contacted, cause personal injury. Observe all safety precautions. Service and adjustments should be performed by trained service personnel only.

f. Connect power to the instrument and set the Power ON/OFF switch to ON.

g. Depress the LCL/INIT key to initialize the instrument.

h. The new firmware number will appear in the SOURCE display for a few seconds before the instrument resumes normal operation.

i. Set the Power ON/OFF switch to OFF and disconnect all power to the instrument.

j. Replace the instrument top cover.

5-15. Component Removal.

Most components are readily accessible for inspection and replacement when the instrument covers are removed. Solid-state circuit components, mounted on plug-in circuit boards, are used throughout the instrument. Standard printed circuit board maintenance techniques are required for removal and replacement of parts. Excessive heat must be avoided; a low wattage soldering iron and suitable heat sinks should be used for all soldering and unsoldering operations.

5-16. INSPECTION.

5-17. If an equipment malfunction occurs, perform a visual inspection of the instrument. Inspect for signs of damage caused by excessive shock, vibration, or overheating, such as broken wires, loose hardware and parts, loose electrical connections, or accumulations of dirt and other foreign matter. Correct any problems discovered, then perform the performance tests to verify that the instrument is operational. If a malfunction persists or the instrument fails any of the performance tests, refer to the adjustment procedure. After the instrument has been adjusted, perform the performance tests again to verify instrument operation.

5-18. PERFORMANCE TESTS.

5-19. The performance tests should be performed about every 12 months or after the instrument has been repaired. The performance tests may also be performed when the instrument is first received to verify instrument performance.

5-20. Initial Calibration. Calibrate the instrument as follows:

a. Set the Power ON/OFF switch to ON.

b. Depress the LCL/INIT key to initialize the instrument.

c. Connect the 50 Hz - 50 kHz Calibrator output to the Analyzer input HI and LOW using the balanced cable and adapters.

d. Set the Calibrator to a frequency of 1 kHz and a level of 3.000 volts and enable the Calibrator output.

e. Enable the Analyzer input float mode.

f. After the Analyzer measurement settles, enter special function 20 which calibrates full scale AC level. The Source display will indicate the - CAL - message momentarily and any errors will be reported. The calibration will take approximately 2 seconds after which the Source display will indicate special function 10.

g. If any of the optional filters are installed, set the calibrator to the reference frequency and level listed in Table 5-2 designated for the filter to be calibrated and enable the Calibrator output.

h. Enter the special function that corresponds to the filter position to be calibrated. Special function 21 will calibrate the optional filter # 1 installed in the leftmost position while special function # 22 calibrates optional filter # 2 installed in the rightmost position. The Source display will indicate the - CAL - message momentarily and any errors will be reported. The calibration will take approximately 1 second after which the Source display will indicate special function 10.

i. Set the Calibrator to a level of 0.000 volts DC.

j. Depress the DC key to enable the DC level measurement mode.

k. After the Analyzer measurement settles, enter special function 23 which calibrates DC level offset. The Source display will indicate the - CAL - message momentarily and any errors will be reported. The calibration will take approximately 2 seconds after which the Source display will indicate special function 10.

l. Set the Calibrator to a level of 3.000 volts DC.

m. After the Analyzer measurement settles, enter special function 24 which calibrates full scale DC level. The Source display will indicate the - CAL - message momentarily and any errors will be reported. The calibration will take approximately 2 seconds after which the Source display will indicate special function 10.

5-21. DC Level Accuracy.
On the Audio Analyzer depress the LCL/INIT key to initialize the instrument. After the initialization sequence is complete enable the DC low-pass filter and enter special function 17 to enable the slow detector mode. Connect the DC Calibrator output using the balanced cable and adapters to the Analyzer input HI and LOW terminals. Enable the Analyzer floating mode and enter the Calibrator settings listed in Table 5-3 and record the Analyzer DC level readings.

5-22. AC Level Accuracy.
The Analyzer AC level accuracy is first verified and recorded using a precision AC/DC calibrator. The Source AC level is then compared directly to the measurement of the calibrator at the same amplitude thereby eliminating any Analyzer measurement errors. To minimize any effects of stray capacitance the output of the Source oscillator is terminated in 600 ohms. The error caused by the output impedance and termination are measured and calculated out.

5-23. Analyzer Level Accuracy.
On the Audio Analyzer depress the LCL/INIT key to initialize the instrument and enter special function 17 to enable the slow detector mode. Connect the 50 Hz - 50 kHz Calibrator

output using the balanced cable and adapters to the Analyzer input HI and LOW terminals. Enable the Analyzer floating mode and enter the Calibrator settings listed in Table 5-4 and record the Analyzer AC level readings.

5-24. Source Output Impedance. On the Audio Analyzer depress the LCL/INIT key to initialize the instrument and enable the Source floating mode. Connect the Source output HI and LOW using the balanced cable and adapters to the Analyzer input HI and LOW. Perform the following procedure.

a. On the Audio Analyzer enter a Source level of 3.000 Volts.

b. Enable the Analyzer Ratio mode.

c. Connect the 600 ohm load across the binding post adapters at the input of the Analyzer.

d. Note the display and calculate the Source output impedance using the following formula and record Z_{out} in Table 5-5.

$$Z_{out} = \left(\frac{100.6\ \%}{\text{disp}\ \%} - 1 \right) * 596.4$$

e. Calculate the impedance correction factor using the following formula and record CalF in Table 5-5.

$$\text{CalF} = \frac{(Z_{out} + 596.4)}{596.4}$$

5-25. Source Level Accuracy. On the Audio Analyzer depress the LCL/INIT key to initialize the instrument. Connect the Source output HI and LOW using the balanced cable and adapters to the Analyzer input HI and LOW. Connect the 600 ohm load across the binding post adapters at the Analyzer input and enable the Analyzer floating mode. Perform the following procedure.

a. On the Audio Analyzer Enter each Source frequency and level setting listed in Table 5-6.

b. Note the analyzer display and calculate the actual output level error using the following formula and record the results in the ACTUAL column in Table 5-6.

$$\text{ACTUAL} = V_{msr} * \text{CalF} - V_{cal}$$

where:

ACTUAL	is the actual Source level
V_{msr}	is the displayed level measurement
CalF	is the Source impedance calibration factor in Table 5-5
V_{cal}	is the identical calibrator measurement in Table 5-4

5-26. AC Level Flatness. The level flatness test is made in the ratio mode where the ratio reference is set at a frequency of 1 kHz and at a specific test level. The frequency is then varied and the resultant relative amplitude errors are measured. In this test the Analyzer flatness is first verified using

the precision AC calibrator and recorded. The Source flatness is then measured at the same test levels and compared to the measurements using the calibrator thereby eliminating the Analyzer measurement errors.

5-27. Analyzer Flatness.
On the Audio Analyzer depress the LCL/INIT key to initialize the instrument and enter special function 17 to enable the slow detector mode. Connect the 10 Hz to 10 MHz Calibrator output using a BNC coax cable and the 50 ohm feedthrough termination to the Analyzer HI input connector. Perform the following procedure for each test level listed in Table 5-7.

a. On the Calibrator enable the wideband source output and enter the Calibrator level at a frequency of 1 kHz.

b. On the Audio Analyzer enable the level ratio mode to set the flatness reference.

c. On the Calibrator enter the test frequencies and special functions indicated in Table 5-7 and record the Analyzer ratio measurements in the ACTUAL column.

5-28. Source Flatness.
On the Audio Analyzer depress the LCL/INIT key to initialize the instrument. Connect the Source output HI and LOW using the balanced cable and adapters to the Analyzer input HI and LOW. Enable the Analyzer floating mode and connect the 600 ohm load across the binding post adapters at the Analyzer input. Perform the following procedure for each test level listed in Table 5-8.

a. On the Audio Analyzer enter the Source level at a frequency of 1 kHz.

b. Enable the level ratio mode to set the flatness reference.

c. Enter the test frequencies indicated in Table 5-8.

d. Note the display and calculate the actual Source flatness by using the formula below and record the result in the ACTUAL column.

$$\textbf{ACTUAL} = \%_{msr} - \%_{act} + 100\ \%$$

where:

ACTUAL	is the actual Source flatness
$\%_{msr}$	is the Analyzer measurement indication.
$\%_{act}$	is the calibrated Analyzer flatness as recorded in Table 5-7

5-29. Frequency Accuracy.
On the Audio Analyzer depress the LCL/INIT key to initialize the instrument. Connect the Source output HI and LOW using the balanced cable and adapters to the Analyzer input HI and LOW. Connect the SYNC output on the rear panel to the Frequency Counter CHANNEL A input. On the Audio Analyzer depress the Analyzer FREQ key and enter a Source level of 3 volts. Set the Frequency Counter controls as follows:

FUNCTION	FREQ A
GATE TIME	100 mS
DISPLAY POSITION	AUTO
LEVEL	PRESET
SLOPE	+
ATTEN	1 MEG, X1
AC/DC	AC
CHECK/COM/SEP	SEP

5-30. For each test frequency listed in table 5-9 perform the following procedure.

a. On the Audio Analyzer set the Source oscillator to the test frequency.

b. Verify that the Source frequency accuracy is within the specified limit using the external Frequency Counter.

c. Record the result, pass or fail in Table 5-9.

d. Verify the Analyzer frequency measurement accuracy by comparing the external counter and Analyzer frequency measurements.

e. Record the result, pass or fail, in Table 5-10.

5-31. Low-Pass Filter Accuracy.
The filter accuracy test is made by setting an amplitude ratio reference at a frequency of 1 kHz and adjusting the frequency at the same reference level for a display of -3.01 dB or 70.7 %. The frequency is then measured and recorded.

5-32. On the Audio Analyzer depress the LCL/INIT key to initialize the instrument. Connect the output of the Test Oscillator to the input of the Audio Analyzer and terminate the Analyzer input with 600 ohms. Set the Test Oscillator to a frequency of 1 kHz +- 10 Hz and a level of 2 volts +- 50 mV. Enable the Analyzer level ratio mode and depress the dB key. Perform the following procedure for each filter listed in Table 5-11.

a. Enable the specified low-pass filter.

b. Adjust the Test Oscillator frequency for a display indication of -3.01 dB +- 0.05 dB.

c. Depress the Analyzer FREQ key and record the frequency in Table 5-11.

5-33. Residual Distortion And Noise.
In this test the Source output is connected to the Analyzer input and the combination of distortion and noise is measured at various frequencies and levels. In this manner the Source and the Analyzer are measured simultaneously. If either the Source or Analyzer is out of specification, a known to be good Source or Analyzer can be substituted to determine which part of the instrument is at fault.

5-34. On the Audio Analyzer depress the LCL/INIT key to initialize the instrument. Connect the Source output HI and LOW using the balanced cable and adapters to the Analyzer input HI and LOW and connect the 600 ohm load across the binding post adapters at the Analyzer input. Enable the Source and Analyzer floating

modes and depress the DIST and DB keys. Perform the following procedure.

a. Enter the source level and frequency listed in Table 5-12.

b. Enable the low-pass filter specified in the BW column.

c. Record the distortion measurement in Table 5-12.

5-35. Residual Signal-to-Noise Ratio. In this test the Source output is connected to the Analyzer input and the residual signal-to-noise is measured at various frequencies and levels. Due to the synchronous nature of the measurement the Source and Analyzer of one instrument must be used together.

5-36. On the Audio Analyzer depress the LCL/INIT key to initialize the instrument. Connect the Source output HI and LOW using the balanced cable and adapters to the Analyzer input HI and LOW and connect the 600 ohm load across the binding post adapters at the Analyzer input. Enable the Source and Analyzer floating modes and depress the S/N key. Perform the following procedure.

a. Enter the Source level and frequency listed in Table 5-13.

b. Enable the low-pass filter specified in the BW column.

c. Record the signal-to-noise measurement in Table 5-13.

5-37. Common Mode Rejection Ratio.
On the Audio Analyzer depress the LCL/INIT key to initialize the instrument. Connect the Source output HI to both Analyzer inputs HI and LOW using BNC cables and a Tee adapter and enable the Analyzer floating mode. Depress the Analyzer LEVEL key and dB key and perform the following procedure.

a. Set the Source oscillator to the test frequency and level listed in Table 5-14.

b. Record the analyzer measurement in Table 5-14.

5-38. Optional Filter Accuracy.
The filter accuracy tests are made by setting an amplitude ratio reference at a reference frequency and recording the relative amplitude at other specified test frequencies. The results are then compared to the specification limits.

5-39. Optional Filter Test Connections.
Perform the test setup as follows:

a. On the Audio Analyzer depress the LCL/INIT key to initialize the instrument.

b. Connect the Source output to the Audio Analyzer input using the balanced able and adapters

c. terminate the Analyzer input with 600 ohms and enable the Analyzer input floating mode.

5-40. 400 Hz High-Pass Filter Accuracy.
Perform the test as follows:

a. Set the Source to a frequency of 1 kHz and a level of 2 volts.

b. Enable the Analyzer level ratio mode and depress the dB key.

c. Enable the 400 Hz high-pass filter.

d. Adjust the Source frequency for an Analyzer display indication of -3.01 dB +- 0.05 dB.

e. Record the Source frequency in Table 5-15.

5-41. CCITT Filter Accuracy.
Perform the test as follows:

a. Set the Source to a frequency of 800 Hz and a level of 2 volts.

b. Enable the Analyzer level ratio mode and depress the dB key.

c. Enable the CCITT weighting filter.

d. Set the Source oscillator to the frequencies listed in Table 5-16 and record the Analyzer level measurements.

5-42. CCIR, CCIR/ARM Filter Accuracy.
Perform the test as follows:

a. Set the Source to a frequency of 1000 Hz for the CCIR filter or 2000 Hz for the CCIR/ARM filter and a level of 2 volts.

b. Enable the Analyzer level ratio mode and depress the dB key.

c. Enable the CCIR or the CCIR/ARM band-pass filter.

d. Set the Source oscillator to the frequencies listed in Table 5-17 or 5-18 for the respective CCIR or CCIR/ARM filter and record the Analyzer level measurements.

5-43. A, B, and C Weighting Filter Accuracy.
Perform the test as follows:

a. Set the Source to a frequency of 1000 Hz and a level of 2 volts.

b. Enable the Analyzer level ratio mode and depress the dB key.

c. Enable the A, B, or C Weighting filter.

d. Set the Source oscillator to the frequencies listed in Table 5-19, 5-20 or 5-21 for the respective A, B, or C weighting filter and record the Analyzer level measurements.

5-44. AUDIO Band-Pass Filter Accuracy.
Perform the test as follows:

a. Set the Source to a frequency of 1 kHz and a level of 2 volts.

b. Enable the Analyzer level ratio mode and depress the dB key.

c. Enable the AUDIO band-pass filter.

d. Set the Source frequency to 22.4 Hz and fine adjust the frequency for an Analyzer display indication of -3.01 dB +- 0.05 dB.

e. Record the Source frequency in Table 5-22.

f. Set the Source frequency to 22.4 kHz and fine adjust the frequency for an Analyzer display indication of -3.01 dB +- 0.05 dB.

g. Record the Source frequency in Table 5-22.

5-45. C-MESSAGE Filter Accuracy.

Perform the test as follows:

a. Set the Source to a frequency of 1000 Hz and a level of 2 volts.

b. Enable the Analyzer level ratio mode and depress the dB key.

c. Enable the C-MESSAGE weighting filter.

d. Set the Source oscillator to the frequencies listed in Table 5-23 and record the Analyzer level measurements.

TABLE 5-3. DC LEVEL ACCURACY TEST RECORD.

DC CALIBRATOR	AUDIO ANALYZER DC LEVEL MEASUREMENT		
LEVEL	MINIMUM	ACTUAL	MAXIMUM
0.500 V	0.488	________	0.512
1.000 V	0.987	________	1.013
2.000 V	1.984	________	2.016
3.000 V	2.981	________	3.019
30.00 V	29.81	________	30.19
300.0 V	298.1	________	301.9
-300.0 V	-298.1	________	-301.9
-30.00 V	-29.81	________	-30.19
-3.000 V	-2.981	________	-3.019
-2.000 V	-1.984	________	-2.016
-1.000 V	-0.987	________	-1.013
-0.500 V	-0.488	________	-0.512

TABLE 5-4. AC LEVEL ACCURACY TEST RECORD.

AC CALIBRATOR		AUDIO ANALYZER AC LEVEL MEASUREMENT		
LEVEL	FREQUENCY	MINIMUM	ACTUAL (V_{CAL})	MAXIMUM
1.000 mV	50 Hz	0.990	________	1.010
3.000 mV	50 Hz	2.970	________	3.030
30.00 mV	50 Hz	29.70	________	30.30
300.0 mV	50 Hz	297.0	________	303.0
3.000 V	50 Hz	2.970	________	3.030
30.00 V	50 Hz	29.70	________	30.30
300.0 V	50 Hz	297.0	________	303.0
1.000 mV	1000 Hz	0.990	________	1.010
3.000 mV	1000 Hz	2.970	________	3.030
30.00 mV	1000 Hz	29.70	________	30.30
300.0 mV	1000 Hz	297.0	________	303.0
3.000 V	1000 Hz	2.970	________	3.030
30.00 V	1000 Hz	29.70	________	30.30
300.0 V	1000 Hz	297.0	________	303.0
1.000 mV	20000 Hz	0.990	________	1.010
3.000 mV	20000 Hz	2.970	________	3.030
30.00 mV	20000 Hz	29.70	________	30.30
300.0 mV	20000 Hz	297.0	________	303.0
3.000 V	20000 Hz	2.970	________	3.030

TABLE 5-4. CONTINUED.

AC CALIBRATOR		AUDIO ANALYZER AC LEVEL MEASUREMENT		
LEVEL	FREQUENCY	MINIMUM	ACTUAL (V_{CAL})	MAXIMUM
1.000 mV	50000 Hz	0.990	______	1.010
3.000 mV	50000 Hz	2.970	______	3.030
30.00 mV	50000 Hz	29.70	______	30.30
300.0 mV	50000 Hz	297.0	______	303.0
3.000 V	50000 Hz	2.970	______	3.030

TABLE 5-5. SOURCE OUTPUT IMPEDANCE ACCURACY TEST RECORD.

SOURCE OUTPUT IMPEDANCE		
PERFORMANCE LIMITS	Z_{OUT}	CalF
600 ohms +- 6 ohms	______ ohms	______ %

TABLE 5-6. SOURCE OUTPUT LEVEL ACCURACY TEST RECORD.

SOURCE OSCILLATOR		AUDIO ANALYZER AC LEVEL MEASUREMENT		
LEVEL (LOADED)	FREQUENCY	MINIMUM	ACTUAL	MAXIMUM
2.000 mV (1.000)	50 Hz	0.845	________	1.155
6.000 mV (3.000)	50 Hz	2.835	________	3.165
60.00 mV (30.00)	50 Hz	29.70	________	30.30
600.0 mV (300.0)	50 Hz	297.0	________	303.0
6.000 V (3.000)	50 Hz	2.982	________	3.018
2.000 mV (1.000)	1000 Hz	0.845	________	1.155
6.000 mV (3.000)	1000 Hz	2.835	________	3.165
60.00 mV (30.00)	1000 Hz	29.70	________	30.30
600.0 mV (300.0)	1000 Hz	297.0	________	303.0
6.000 V (3.000)	1000 Hz	2.982	________	3.018
2.000 mV (1.000)	20000 Hz	0.845	________	1.155
6.000 mV (3.000)	20000 Hz	2.835	________	3.165
60.00 mV (30.00)	20000 Hz	29.70	________	30.30

TABLE 5-6. CONTINUED.

SOURCE OSCILLATOR		AUDIO ANALYZER AC LEVEL MEASUREMENT		
LEVEL (LOADED)	FREQUENCY	MINIMUM	ACTUAL	MAXIMUM
600.0 mV (300.0)	20000 Hz	297.0	________	303.0
6.000 V (3.000)	20000 Hz	2.982	________	3.018
2.000 mV (1.000)	50000 Hz	0.845	________	1.155
6.000 mV (3.000)	50000 Hz	2.835	________	3.165
60.00 mV (30.00)	50000 Hz	29.70	________	30.30
600.0 mV (300.0)	50000 Hz	297.0	________	303.0
6.000 V (3.000)	50000 Hz	2.982	________	3.018

TABLE 5-7. ANALYZER AC LEVEL FLATNESS TEST RECORD.

AC CALIBRATOR		AUDIO ANALYZER AC RATIO MEASUREMENT			
LEVEL	**FREQUENCY**	**SPCL**	**MINIMUM**	**ACTUAL ($\%_{ACT}$)**	**MAXIMUM**
1.000 mV	10 Hz		98.00	________	102.00
1.000 mV	20 Hz		99.00	________	101.00
1.000 mV	50 Hz		99.50	________	100.50
1.000 mV	50000 Hz		99.50	________	100.50
1.000 mV	100000 Hz		99.00	________	101.00
15.00 mV	10 Hz		98.00	________	102.00
15.00 mV	20 Hz		99.00	________	101.00
15.00 mV	50 Hz		99.50	________	100.50
15.00 mV	50000 Hz		99.50	________	100.50
15.00 mV	100000 Hz		99.00	________	101.00
50.00 mV	10 Hz		98.00	________	102.00
50.00 mV	20 Hz		99.00	________	101.00
50.00 mV	50 Hz		99.50	________	100.50
50.00 mV	50000 Hz		99.50	________	100.50
50.00 mV	100000 Hz		99.00	________	101.00
3.000 V	10 Hz	28	98.00	________	102.00
3.000 V	20 Hz	28	99.00	________	101.00
3.000 V	50 Hz	28	99.50	________	100.50
3.000 V	50000 Hz	28	99.50	________	100.50

TABLE 5-7. CONTINUED.

AC CALIBRATOR		AUDIO ANALYZER AC RATIO MEASUREMENT			
LEVEL	FREQUENCY	SPCL	MINIMUM	ACTUAL ($\%_{ACT}$)	MAXIMUM
3.000 V	100000 Hz	28	99.00	______	101.00
30 VOLT RANGE					
3.000 V	50 Hz	27	99.50	______	100.50
3.000 V	50000 Hz	27	99.50	______	100.50
3.000 V	100000 Hz	27	99.00	______	101.00
300 VOLT RANGE					
3.000 V	50 Hz	26	99.50	______	100.50
3.000 V	50000 Hz	26	99.50	______	100.50
3.000 V	100000 Hz	26	99.00	______	101.00

TABLE 5-8. SOURCE LEVEL FLATNESS TEST RECORD.

SOURCE OSCILLATOR		AUDIO ANALYZER AC RATIO MEASUREMENT		
LEVEL (LOADED)	FREQUENCY	MINIMUM	ACTUAL	MAXIMUM
30.0 mV (15.0)	10 Hz	99.50	________	100.50
30.0 mV (15.0)	20 Hz	99.50	________	100.50
30.0 mV (15.0)	50 Hz	99.50	________	100.50
30.0 mV (15.0)	50000 Hz	99.50	________	100.50
30.0 mV (15.0)	100000 Hz	99.00	________	101.00
6.00 V (3.00)	10 Hz	99.50	________	100.50
6.00 V (3.00)	20 Hz	99.50	________	100.50
6.00 V (3.00)	50 Hz	99.50	________	100.50
6.00 V (3.00)	50000 Hz	99.50	________	100.50
6.00 V (3.00)	100000 Hz	99.00	________	101.00

TABLE 5-9. SOURCE FREQUENCY ACCURACY TEST RECORD.

SOURCE OSCILLATOR	FREQUENCY COUNTER MEASUREMENT			
FREQUENCY	**MINIMUM**	**PASS**	**FAIL**	**MAXIMUM**
190.000 Hz	189.997	____	____	190.003
1900.00 Hz	1899.97	____	____	1900.03
19000.0 Hz	18999.7	____	____	19000.3
140000 Hz	139997	____	____	140003

TABLE 5-10. ANALYZER FREQUENCY ACCURACY TEST RECORD.

SOURCE OSCILLATOR	ANALYZER FREQUENCY MEASUREMENT ERROR			
FREQUENCY	**MINIMUM**	**PASS**	**FAIL**	**MAXIMUM**
190.000 Hz	-0.001 Hz	____	____	+0.001 Hz
1900.00 Hz	-0.01 Hz	____	____	+0.01 Hz
19000.0 Hz	-0.1 Hz	____	____	+0.1 Hz
140000 Hz	-1 Hz	____	____	+1 Hz

TABLE 5-11. LOW-PASS FILTER ACCURACY TEST RECORD.

LOW-PASS FILTER	ANALYZER FREQUENCY MEASUREMENT		
	MINIMUM	ACTUAL	MAXIMUM
30 kHz	28 kHz	________	32 kHz
80 kHz	76 kHz	________	84 kHz
220 kHz	200 kHz	________	240 kHz

TABLE 5-12. RESIDUAL DISTORTION AND NOISE TEST RECORD.

SOURCE OSCILLATOR		AUDIO ANALYZER DISTORTION MEASUREMENT		
LEVEL	FREQUENCY	BW	ACTUAL	MAXIMUM
6.000 V	10 Hz	80 kHz	________	-80.00 dB
6.000 V	20 Hz	80 kHz	________	-80.00 dB
6.000 V	100 Hz	80 kHz	________	-80.00 dB
6.000 V	1000 Hz	80 kHz	________	-80.00 dB
6.000 V	10000 Hz	80 kHz	________	-80.00 dB
6.000 V	20000 Hz	80 kHz	________	-80.00 dB
6.000 V	50000 Hz	220 kHz	________	-74.00 dB
6.000 V	100000 Hz	500 kHz	________	-65.00 dB
3.000 V	140000 Hz	500 kHz	________	-60.00 dB

TABLE 5-13. RESIDUAL SIGNAL-TO-NOISE RATIO TEST RECORD.

SOURCE OSCILLATOR		AUDIO ANALYZER SIGNAL-TO-NOISE MEASUREMENT		
LEVEL	FREQUENCY	BW	ACTUAL	MAXIMUM
3.000 V	10 Hz	80 kHz	________	-80.00 dB
3.000 V	20 Hz	80 kHz	________	-80.00 dB
3.000 V	100 Hz	80 kHz	________	-80.00 dB
3.000 V	1000 Hz	80 kHz	________	-80.00 dB
3.000 V	10000 Hz	80 kHz	________	-80.00 dB
3.000 V	20000 Hz	80 kHz	________	-80.00 dB
3.000 V	50000 Hz	220 kHz	________	-80.00 dB
3.000 V	100000 Hz	500 kHz	________	-80.00 dB
3.000 V	140000 Hz	500 kHz	________	-80.00 dB

TABLE 5-14. COMMON MODE REJECTION RATIO TEST RECORD.

SOURCE OSCILLATOR		ANALYZER AC LEVEL MEASUREMENT	
LEVEL	FREQUENCY	ACTUAL	MAXIMUM
1.000 V	20 Hz	________	-70.00 dB
1.000 V	60 Hz	________	-70.00 dB
1.000 V	1000 Hz	________	-70.00 dB
1.000 V	20000 Hz	________	-40.00 dB

TABLE 5-15. 400 HZ HIGH-PASS FILTER ACCURACY TEST RECORD.

HIGH-PASS FILTER	ANALYZER COUNTER MEASUREMENT		
	MINIMUM	ACTUAL	MAXIMUM
400 Hz	360 Hz	________	440 Hz

TABLE 5-16. CCITT FILTER ACCURACY TEST RECORD.

AUDIO ANALYZER CCITT FILTER ACCURACY			
FREQUENCY	MINIMUM	ACTUAL	MAXIMUM
50.00 Hz	-65.0	________	-61.0
100.00 Hz	-43.0	________	-39.0
200.00 Hz	-23.0	________	-19.0
300.00 Hz	-11.6	________	-9.6
400.00 Hz	-7.3	________	-5.3
800.00 Hz	-0.2	________	0.2
1000.0 Hz	0.0	________	2.0
1200.0 Hz	-1.0	________	1.0
1600.0 Hz	-2.7	________	-0.7
2000.0 Hz	-4.0	________	-2.0
3000.0 Hz	-6.6	________	-4.6
3500.0 Hz	-10.6	________	-6.5
4000.0 Hz	-18.0	________	-12.0
5000.0 Hz	-39.0	________	-33.0

TABLE 5-17. CCIR FILTER ACCURACY TEST RECORD.

AUDIO ANALYZER CCIR FILTER ACCURACY			
FREQUENCY	**MINIMUM**	**ACTUAL**	**MAXIMUM**
31.50 Hz	-30.0	____________	-28.0
63.00 Hz	-24.9	____________	-22.9
100.00 Hz	-20.8	____________	-18.8
200.00 Hz	-14.3	____________	-13.3
400.00 Hz	-8.3	____________	-7.3
800.00 Hz	-2.4	____________	-1.4
1000.0 Hz	-0.5	____________	0.5
2000.0 Hz	5.1	____________	6.1
3150.0 Hz	8.5	____________	9.5
4000.0 Hz	10.0	____________	11.0
5000.0 Hz	11.2	____________	12.2
6300.0 Hz	12.0	____________	12.4
7100.0 Hz	11.8	____________	12.2
8000.0 Hz	11.0	____________	11.8
9000.0 Hz	9.7	____________	10.5
10.000 kHz	7.7	____________	8.5
12.500 kHz	-1.0	____________	1.0
14.000 kHz	-6.3	____________	-4.3
16.000 kHz	-12.7	____________	-10.7
20.000 kHz	-23.2	____________	-21.2
31.500 kHz	-44.7	____________	-40.7

TABLE 5-18. CCIR/ARM FILTER ACCURACY TEST RECORD.

AUDIO ANALYZER CCIR/ARM FILTER ACCURACY			
FREQUENCY	MINIMUM	ACTUAL	MAXIMUM
31.50 Hz	-35.6	________	-33.6
63.00 Hz	-30.5	________	-28.5
100.00 Hz	-26.4	________	-24.4
200.00 Hz	-19.9	________	-18.9
400.00 Hz	-13.9	________	-12.9
800.00 Hz	-8.0	________	-7.0
1000.0 Hz	-6.1	________	-5.1
2000.0 Hz	-0.5	________	0.5
3150.0 Hz	2.9	________	3.9
4000.0 Hz	4.4	________	5.4
5000.0 Hz	5.6	________	6.6
6300.0 Hz	6.4	________	6.8
7100.0 Hz	6.2	________	6.6
8000.0 Hz	5.4	________	6.2
9000.0 Hz	4.1	________	4.9
10.000 kHz	2.1	________	2.9
12.500 kHz	-6.6	________	-4.6
14.000 kHz	-11.9	________	-9.9
16.000 kHz	-18.3	________	-16.3
20.000 kHz	-28.8	________	-26.8
31.500 kHz	-50.3	________	-46.3

TABLE 5-19. A WEIGHTING FILTER ACCURACY TEST RECORD.

AUDIO ANALYZER A WEIGHTING FILTER ACCURACY			
FREQUENCY	**MINIMUM**	**ACTUAL**	**MAXIMUM**
19.95 Hz	-52.0	________	-48.0
31.62 Hz	-40.9	________	-37.9
50.12 Hz	-31.2	________	-29.2
100.00 Hz	-20.1	________	-18.1
199.50 Hz	-11.9	________	-9.9
316.20 Hz	-7.6	________	-5.6
501.20 Hz	-4.2	________	-2.2
1000.0 Hz	-0.2	________	0.2
1995.0 Hz	0.2	________	2.2
3162.0 Hz	0.2	________	2.2
5012.0 Hz	-1.0	________	2.0
10.000 kHz	-4.0	________	-1.0
19.950 kHz	-11.3	________	-7.3

TABLE 5-20. B WEIGHTING FILTER ACCURACY TEST RECORD.

AUDIO ANALYZER B WEIGHTING FILTER ACCURACY			
FREQUENCY	MINIMUM	ACTUAL	MAXIMUM
19.95 Hz	-26.2	________	-22.2
31.62 Hz	-15.7	________	-12.7
50.12 Hz	-12.6	________	-10.6
100.00 Hz	-6.6	________	-4.6
199.50 Hz	-3.0	________	-1.0
316.20 Hz	-1.8	________	0.2
501.20 Hz	-1.3	________	0.7
1000.0 Hz	-0.2	________	0.2
1995.0 Hz	-1.1	________	0.9
3162.0 Hz	-1.4	________	0.6
5012.0 Hz	-2.7	________	0.3
10.000 kHz	-5.8	________	-2.8
19.950 kHz	-13.1	________	-9.1

TABLE 5-21. C WEIGHTING FILTER ACCURACY TEST RECORD.

AUDIO ANALYZER C WEIGHTING FILTER ACCURACY			
FREQUENCY	**MINIMUM**	**ACTUAL**	**MAXIMUM**
19.95 Hz	-8.2	________	-4.2
31.62 Hz	-4.5	________	-1.5
50.12 Hz	-2.3	________	-0.3
100.00 Hz	-1.3	________	0.7
199.50 Hz	-1.0	________	1.0
316.20 Hz	-1.0	________	1.0
501.20 Hz	-1.0	________	1.0
1000.0 Hz	-0.2	________	0.2
1995.0 Hz	-1.2	________	0.8
3162.0 Hz	-1.5	________	0.5
5012.0 Hz	-2.8	________	0.2
10.000 kHz	-5.9	________	-2.9
19.950 kHz	-13.2	________	-9.2

TABLE 5-22. AUDIO BAND-PASS FILTER ACCURACY TEST RECORD.

BAND-PASS FILTER	ANALYZER COUNTER MEASUREMENT		
	MINIMUM	**ACTUAL**	**MAXIMUM**
22.4 Hz	21.28 Hz	________	23.52 Hz
22.4 kHz	21.28 kHz	________	23.52 kHz

TABLE 5-23. C-MESSAGE FILTER ACCURACY TEST RECORD.

AUDIO ANALYZER C-MESSAGE FILTER ACCURACY			
FREQUENCY	MINIMUM	ACTUAL	MAXIMUM
60.00 Hz	-57.7	________	-53.7
100.00 Hz	-44.5	________	-40.5
200.00 Hz	-27.0	________	-23.0
300.00 Hz	-17.5	________	-15.5
400.00 Hz	-12.4	________	-10.4
800.00 Hz	-2.5	________	-0.5
1000.0 Hz	-0.2	________	0.2
1200.0 Hz	-1.2	________	0.8
1800.0 Hz	-2.3	________	-0.3
2500.0 Hz	-2.4	________	-0.4
3000.0 Hz	-3.5	________	-1.5
3500.0 Hz	-9.6	________	-5.6
4000.0 Hz	-17.5	________	-11.5
5000.0 Hz	-31.5	________	-25.5

5-46. ADJUSTMENTS.

5-47. The Model 1120 adjustments are listed in Table 5-24. Test equipment required for the adjustments is listed in Table 5-1.

5-48. A11 Power Supply Adjustment.

5-49. The power supply has only one adjustment which is the power supply Power Fail Adjustment. The Power Fail Adjustment sets the low line trip level that interrupts the processor operation until the proper AC voltage is applied.

5-50. A11R4 Power Fail Adjustment.

Perform the adjustment as follows:

a. Disconnect all power to the Audio Analyzer and remove the top cover.

b. Set the rear panel line voltage switch to the appropriate voltage.

c. Verify that the line fuse is the proper value as

TABLE 5-24. LIST OF ADJUSTMENTS.

ADJUSTMENT	LOCATION
A11R4 Power Fail	Power Supply Board
A5Y1 Timebase Frequency	C.P.U. Board
A7R21 Attenuator Bit 2	Output Board
A7R17 Attenuator Bit 1	Output Board
A7R15 Attenuator Bit 0	Output Board
A6R2 Source Level	Source Board
A3R46 Notch Balance	Notch Board
A3R49 Notch Tune	Notch Board
A0R29 3 V Range CMRR	Input Board
A0R27 30 V Range CMRR	Input Board
A0R7 300 V Range CMRR	Input Board
A0C5 HI Input 30 V Range Flatness	Input Board
A0C32 HI Input 300 V Range Flatness	Input Board
A0C10 LOW Input 30 V Range Flatness	Input Board
A0C33 LOW Input 300 V Range Flatness	Input Board
A37R11 CCIR, CCIR/ARM Cal	CCIR/ARM Filter Board

listed on the LINE VOLTAGE SELECT chart located on the rear panel.

d. Connect the variac to an appropriate power source and adjust for a line indication of nominal - 10 % (90, 108, 200 or 216 volts).

WARNING
There are voltages at various points in the instrument which can, if contacted, cause personal injury. Observe all safety precautions.

e. Connect the Audio Analyzer power cord to the variac and set the POWER ON/OFF switch to ON.

f. Observe the display and adjust A11R4 clockwise until the display just blanks, then slowly counterclockwise until the display returns.

5-51. A5 C.P.U. Adjustment.

5-52. The only adjustment on the C.P.U. Board is the Timebase Frequency Adjustment which is adjusted to provide the specific frequency accuracy for the system time standard.

5-53. A5Y1 Timebase Frequency Adjustment.
Perform the procedure as follows:

a. Remove the IEEE-488 interface cable on the C.P.U. Board.

b. Remove the cover screw in the top of A5Y1 to expose the trimmer adjustment.

c. Connect the House Standard frequency reference to the rear panel X CLK input.

d. Set the Option switches A4S1-7 and A4S1-8 to the open position and depress the LCL/INIT key.

e. Observe the Source display and adjust A5Y1 until the display indicates 10000.00 kHz +- 1 count.

f. Set the Option switches A4S1-7 and A4S1-8 to the closed position, replace the cover screw and cable.

5-54. A7 Output Board Adjustments.

5-55. The Output Board adjustments consist of three attenuator adjustments which trim the most significant bits of the programmable attenuator for optimum source level accuracy.

5-56. A7R21 Bit 2, A7R17 Bit 1, and A7R15 Bit 0 Adjustments. Perform the adjustments as follows:

a. Connect the Source output HI and LOW to the Multimeter input HI and LOW using the balanced cable and adapters.

b. Set the Multimeter to measure AC level.

c. On the Audio Analyzer depress the LCL/INIT key and set the Source level to 511 mV.

d. Observe the Multimeter display.

e. Set the Source level to

512 mV and adjust A7R21 for an increase of 1 mV +- 0.3 mV above the measurement in step d above.

f. Set the Source level to 1023 mV.

g. Observe the Multimeter display.

h. Set the Source level to 1024 mV and adjust A7R17 for an increase of 1 mV +- 0.5 mV above the measurement in step g above.

i. Set the Source level to 2047 mV.

j. Observe the Multimeter display.

k. Set the Source level to 2048 mV and adjust A7R15 for an increase of 1 mV +- 0.5 mV above the measurement in step j above.

5-57. A6 Source Board Adjustments.

5-58. The only adjustment on the Source Board is the Source Level Adjustment which sets the full scale output level of the Source oscillator.

5-59. A6R2 Source Level Adjustment.
Perform the adjustments as follows:

a. Connect the 50 Hz - 50 kHz Calibrator output to the Analyzer input using the balanced cable and adapters.

b. On the Audio Analyzer depress the LCL/INIT key to initialize the instrument.

c. Set the Calibrator to 1.000 kHz and 2.982 volts and enable the Calibrator output.

d. After the Analyzer measurement settles, depress the RATIO key to enable the level ratio mode.

e. Disconnect the Calibrator and connect the Source output HI and LOW to the Analyzer input HI and LOW using the balanced cable and adapters.

f. Set the Source level to 3.000 volts and adjust A6R2 for an Analyzer level ratio display of 100.00 % +- 0.1 %.

5-60. A3 Notch Board Adjustments.

5-61. The Notch Board adjustments consist of A3R46 Notch Balance and A3R49 Notch Tune. These adjustments compensate for offsets in the notch filter which could reduce the effective depth of the notch.

5-62. A3R46 Notch Balance and A3R49 Notch Tune Adjustments.
Perform the adjustments as follows:

a. On the Audio Analyzer depress the LCL/INIT key to initialize the instrument.

b. Connect the Source output HI and LOW to the Analyzer input HI and LOW using the balanced cable and adapters.

c. Connect the Wave Analyzer input to the MONITOR output on the rear panel of the Audio Analyzer.

d. Set the Wave Analyzer controls as follows:

SCALE	90 dB
FREQUENCY	1 kHz
AMPLITUDE REF LEVEL	NORMAL
INPUT SENSITIVITY	10 dB
RESOLUTION BANDWIDTH	3 Hz
AFC	LOCK
SWEEP MODE	OFF

e. Set the Source level to 3.000 volts and depress the Analyzer DIST key.

F. Observe the Wave Analyzer and alternately adjust A3R46 and A3R49 for a minimum indication. The null measurement should be in excess of 60 dB.

5-63. A0 Input Board Adjustments.

5-64. The Input Board adjustments consist of three common mode rejection adjustments: A0R29 3 V Range CMRR, A0R27 30 V Range CMRR and A0R7 300 V Range CMRR, and four flatness adjustments: A0C5 HI Input 30 V Range Flatness, A0C32 HI Input 300 V Range Flatness, A0C10 LOW Input 30 V Flatness, and A0C33 LOW Input 300 V Flatness.

5-65. A0R29 3 V Range CMRR, A0R27 30 V Range CMRR, and A0R7 300 V Range CMRR.
Perform the adjustments as follows:

a. On the Audio Analyzer depress the LCL/INIT key to initialize the instrument.

b. Enable the Analyzer input float mode and connect the Source output HI to the Analyzer input HI and LOW using BNC cables and a TEE adapter.

c. Connect the Wave Analyzer input to the MONITOR output on the rear panel of the Audio Analyzer.

d. Set the Wave Analyzer controls as follows:

SCALE	90 dB
FREQUENCY	1 kHz
AMPLITUDE REF LEVEL	NORMAL
INPUT SENSITIVITY	10 dB
RESOLUTION BANDWIDTH	30 Hz
AFC	LOCK
SWEEP MODE	OFF

e. Set the Source level to 3.000 volts and enter special function 28.

f. Observe the Wave Analyzer and adjust A0R29 for a minimum indication. The null measurement should be in excess of 60 dB.

g. Enter special function 27.

h. Observe the Wave Analyzer and adjust A0R27 for a minimum indication. The null measurement should be in excess of 60 dB.

i. Enter special function 26.

j. Observe the Wave Analyzer and adjust A0R7 for a minimum indication. The null measurement should be in excess of 60 dB.

5-66. A0C5, A0C32, A0C10, and A0C33 Flatness Adjustments.
Perform the adjustments as follows:

a. On the Audio Analyzer depress the LCL/INIT key to initialize the instrument.

b. Enable the Analyzer floating mode and connect the Source output HI and LOW to the Analyzer input HI and LOW using the balanced cable and adapters.

c. Set the Source oscillator frequency to 100 kHz and level to 3.000 volts.

d. Enter special functions 17 and 28.

e. Depress the RATIO key to enable the Analyzer level ratio mode.

f. Enter special function 27.

g. Note the display and adjust A0C5 for an indication of 100.00 % +- 0.1 %.

h. Enter special function 26.

i. Note the display and adjust A0C32 for an indication of 100.00 % +- 0.1 %.

j. Connect the Source output HI and LOW to the Analyzer input LOW and HI by reversing the balanced cable.

k. Depress the Analyzer RATIO key to disable the level ratio mode.

l. Enter special function 28.

m. Depress the Analyzer RATIO key to enable the level ratio mode.

n. Enter special function 27.

o. Note the display and adjust A0C10 for an indication of 100.00 % +- 0.1 %.

p. Enter special function 26.

q. Note the display and adjust A0C33 for an indication of 100.00 % +- 0.1 %.

5-67. A37 CCIR, CCIR/ARM Optional Filter Board Adjustment.

5-68. The CCIR, CCIR/ARM optional filter board adjustment consist of A37R11 Cal. The adjustment sets the high-pass weighting response and is identical for both the CCIR and the CCIR/ARM filter applications.

5-69. A37R11 CCIR, CCIR/ARM Cal Adjustment.
Perform the adjustment as follows:

a. On the Audio Analyzer depress the LCL/INIT key to initialize the instrument.

b. Connect the Source output HI and LOW to the Analyzer input HI and LOW using the balanced cable and adapters.

c. Enable the CCIR or CCIR/ARM filter.

d. Set the Source frequency to 6.300 kHz at a level of 3.000 volts.

e. Enable the Analyzer level

ratio mode and depress the dB key.

f. Set the Source frequency to 1.000 kHz.

g. Adjust A37R11 for a Analyzer display of -12.20 dB +- 0.05 dB.

h. Set the Source frequency to 6.300 kHz and note the Analyzer ratio measurement. If the display indication is not 0.00 +- 0.05 dB then disable the ratio mode and repeat steps e through h.

5-70. TROUBLESHOOTING.

5-71. Instrument malfunction will generally be evident from front panel indications, or IEEE-488 bus responses. The problems will fall into two general categories: catastrophic failures or selective failure of one subsystem.

5-72. Catastrophic failures would generally cause the Model 1120 to be completely inoperative. For instance, if the microprocessor was not operating properly, the display would contain meaningless symbols and the keyboard would not be responsive. Such failures are usually located in the power supply circuits, interconnecting cables, and the CPU plug-in board.

5-73. Selective failures and performance out of specification are usually limited to one section of the instrument and will be evident from manipulation of the front panel controls. For example, incorrect or erratic source amplitude at various level setting over the entire amplitude range of the source oscillator will indicate a fault in the ALC circuits on the Source plug-in board. However, if the error is limited to one specific amplitude range, the fault may be found on the Output plug-in board in the level ranging circuits. Further isolation of the problem requires an understanding of the simplified block diagrams detailed in the theory of operation section of this manual and experience in troubleshooting analog and digital circuits.

5-74. TROUBLE LOCALIZATION.

5-75. The analog circuits of the Model 1120 are divided into two sections: source circuits and analyzer circuits. The power supply and digital circuits including the frequency counter, CPU, display, and keyboard are common to both analog sections.

5-76. Special Diagnostic Function Codes.

Special function codes 30 through 34 are provided to localize selective failures in the analog and frequency counter circuits. When entered, these codes continuously execute the designated test sequence until the LCL/INIT key is depressed.

5-77. During the Analyzer level range and counter tests, error codes are reported if a fault is encountered. Table 5-26 lists the ranges, error codes and probable causes to aid in localizing a fault.

5-78. DAC Test Code.
Contained in the Model 1120 are three digital-to-analog converters (DAC) which can be configured to generate a low frequency ramp waveform using special function 30. A coarse stepped ramp waveform is usually an indication of missing data bits in the DAC circuits. The display will indicate the "dac tst" message when the test is active.

5-79. The first 12 bit DAC, A7U1, is used to fine tune the source oscillator frequency and is located on the Output plug-in board. The ramp can be found at A7U2 pin 7 (TP3) and will have a peak to peak amplitude of 20 volts from -6 to +14 volts.

5-80. The remaining two 12 bit DACs are used to generate the rear panel X AXIS and Y AXIS outputs. The ramps from these DACs can be found at the rear panel recorder output connectors and will have a peak amplitude extending form 0 to +5 volts. The PEN output is toggled between 0 an +5 volts at the ramp frequency to provide an external sync signal.

5-81. Counter Plug-in Board Test Code.
The period counter can be tested using special function 31. In this test sequence the counter is configured to measure the timebase reference. The reference is divided in decade increments from 1 to 10,000 in the period ranging circuits. Each of the five frequency ranges is sequentially checked for accuracy while the Analyzer display indicates the range being tested. The Source display will indicate an error code if a fault is evident on the tested range.

5-82. Input Plug-in Board Test Code.
The Input plug-in board can be tested using special function 32. In this test sequence an external signal source set to 1 kHz and 3 volts is required. The HIGH and LOW inputs can be checked separately by enabling the float mode and connecting the signal source to either input. Each of the seven level ranges is sequentially checked for accuracy while the Analyzer display indicates the range being tested. The Source display will indicate an error code if a fault is evident on the tested range.

5-83. Filter Plug-in Board Test Code.
The Filter plug-in board can be tested using special function 33. In this test sequence an external signal source set to 1 kHz and 30 millivolts is applied to the Analyzer input. Each of the five level ranges is sequentially checked for accuracy while the Analyzer display indicates the range being tested. The Source display will indicate an error code if a fault is evident on the tested range.

5-84. Notch And Deteotor Plug-in Board Test Code.
The Notch and Detector plug-in boards can be tested using special function 34. In this test sequence an external signal source set to 1 kHz and 300 millivolts is applied to the Analyzer input. Each of the

seven post notch detector ranges is sequentially checked for accuracy while the Analyzer display indicates the range being tested. The Source display will indicate an error code if a fault is evident on the tested range.

TABLE 5-25. DIAGNOSTIC ERROR CODES.

FAULT	DESCRIPTION	PROBABLE CAUSE
Error 30	10 - 65 Hz freq. lock	A6Q5, A6Q17, A6U13
Error 31	65 - 650 Hz freq. lock	A6Q4, A6Q16, A6U13
Error 32	0.65 - 3.5 kHz freq. lock	A6Q3, A6Q15, A6U13
Error 33	3.5 - 25 kHz freq. lock	A6Q2, A6Q14, A6U13
Error 34	25 - 140 kHz freq. lock	A6Q2-Q5, A6Q14-Q17, A6U13
All 30-34	10 Hz - 140 kHz freq. lock	A6Q18-25, A6Q6-13, A6U1, A6U7, A6U8 A6U13-17, A7U1-U3
Error 40	Autocal Detector rms conv.	A3U11, A3U13, Q1, A4U20, A4U21
Error 41	Autocal Detector avg conv.	A3U10, A3U13, Q2, A4U20, A4U21
Error 42	Autocal Input rms conv.	A1U6, A4U20, A4U21
Error 43	Autocal DC full scale	A0U7, A0U4, A0U2, A4U20, A4U21
Error 45	Autocal Filter Option # 2	A1U4, A1U7, A1U8
Error 46	Autocal DC offset	A0U7, A0U4, A0U2, A0K4, A0K5, A4U20, A4U21
Error 47	Autocal Filter Option # 1	A1U4, A1U7, A1U8

TABLE 5-25. CONTINUED.

FAULT	DESCRIPTION	PROBABLE CAUSE
Error 50	199.999 Hz range	A4U5, A4U9, A4U13
Error 51	1.99999 kHz range	A4U6, A4U9, A4U13
Error 52	19.9999 kHz range	A4U6, A4U9, A4U13
Error 53	199.999 kHz range	A4U7, A4U9, A4U13
Error 54	1999.99 kHz range	A4U7, A4U9, A4U13
All 50-54	Counter accumulator	A4U5, A4U9, A4U10, A4U3, A4U12-16, A5Y1
Error 60	300 V range	A0K6, A0K7, A0U1
Error 61	150 V range	A0K6, A0K7, A0U1, A0K2, A0U2, A0U6
Error 62	75 V range	A0K6, A0K7. A0U1, A0K1, A0U2, A0U6
Error 63	30 V range	A0K8, A0K9, A0U1,
Error 64	15 V range	A0K8, A0K9, A0U1, A0K2, A0U2, A0U6
Error 65	7.5 V range	A0K8, A0K9, A0U1, A0K1, A0U2, A0U6
Error 66	3.0 V range	A0K1, A0K2, A0U1, A0U2, A0U6
All 60-66	300 - 3 V ranges	A0U4, A0U5, A0U8, A0U9, A0F1, A0F2

TABLE 5-25. CONTINUED.

FAULT	DESCRIPTION	PROBABLE CAUSE
Error 67	1500 mV range	A1U1-U4
Error 68	750 mV range	A1U1-U4
Error 69	300 mV range	A1U1-U4
Error 70	150 mV range	A1U1-U4
Error 80	0.1 % range	A3U1-U2, A3U5-U6
Error 81	0.2 % range	A3U1-U2, A3U5-U6
Error 82	0.5 % range	A3U1-U2, A3U5-U6
Error 83	1.0 % range	A3U1-U2, A3U5-U6
Error 84	2.0 % range	A3U2-U4
Error 85	5.0 % range	A3U2-U4
Error 86	10 % range	A3U2-U4
Error 87	20 % range	A2U4, A2U10-U12
Error 88	50 % range	A2U4, A2U10-U12
Error 89	100 % range	A2U4, A2U10-U12
All 80-89	0.1 - 100 % ranges	A3K1, A3U2, A3U8-U13

SECTION VI
PARTS LIST

6-1. INTRODUCTION.

6-2. The replaceable parts for the Model 1120 are listed in Table 6-2. The replaceable parts list contains the reference symbol, description, manufacturer, and both the BEC and manufacturer part numbers. Table 6-1 lists the manufacturer's federal supply code numbers.

TABLE 6-1. MANUFACTURER'S FEDERAL SUPPLY CODE NUMBERS.

NO.	NAME
01121	Allen Bradley
01295	Texas Instruments
02114	Ferroxcube Corp.
02735	RCA Solid State Division
03888	Pyrofilm (KDI)
04222	AVX Ceramics Company
04713	Motorola Semiconductor
04901	Boonton Electronics Corporation
06383	Panduit Corporation
06665	Precision Monolithics
06776	Robinson Nugent, Inc.
07263	Fairchild Semiconductor
11961	Semicon
13812	Dialco Division of Amperex
14655	Cornell-Dubilier
14752	Electro Cube, Inc.
15636	Elec-Trol
17856	Siliconix, Inc.
18324	Signetics Corporation
19505	Applied Eng'r. Products
19701	Mepco Electra
20307	Arco - Micronics
24226	Gowanda Electronics
27014	National Semiconductor
27264	Molex, Inc.
27735	F-Dyne Electronics
27802	Vectron Labs
28480	Hewlett-Packard Corporation
31313	Components Corporation
31781	EDAC
31918	ITT Schadow, Inc.

TABLE 6-1. CONTINUED.

NO.	NAME
32293	Intersil, Inc.
32575	AMP
33297	NEC
33883	RMC
34335	Advanced Micro Devices
34371	Harris Semiconductor
34899	Fair-rite
49956	Raytheon Corporation
51406	Murata Corporation of America
51640	Analog Devices, Inc.
54420	Dage - MTI
54426	Buss Fuses
54473	Panasonic
56289	Sprague Electric Company
56708	Zilog, Inc.
57582	Kahgan Electronics Corporation
61637	Kemet - Union Carbide
64537	Pyrofilm (KDI)
71450	CTS Corporation
73138	Beckman Instruments, Helipot Division
74970	E. F. Johnson
75915	Littlefuse
81073	Grayhill
82389	Switchcraft
91293	Johanson
91637	Dale Electronics
95348	Gordos Corporation
98291	Sealectro Corporation
S4217	United Chemicon, Inc.

11200202A REV: D* ASSEMBLY 1120
MODEL: 1120

REFERENCE DESIGNATOR	DESCRIPTION	FED. CODE	MANUFACTURER PART NUMBER	QTY	BEC PART NUMBER
A0	PWA INPUT 1120,30	04901	11201600A	1	11201600A
A1	PWA MAIN FILTER 1120/30	04901	11203500A	1	11203500A
A2	PWA NOTCH FILTER 1120	04901	11201700A	1	11201700A
A3	PWA DETECTOR 1120	04901	11201800A	1	11201800A
A4	PWA FREQUENCY COUNTER 1120	04901	11201900A	1	11201900A
A5	PWA CPU 1120	04901	11202000A	1	11202000A
A6	PWA SOURCE 1120	04901	11202100A	1	11202100A
A7	PWA OUTPUT 1120	04901	11202200B	1	11202200B
A9	PWA EXTENDER	04901	08252300A	1	08252300A
A10	PWA MOTHER 1120	04901	11201500A	1	11201500A
A11	PWA POWER SUPPLY 1120	04901	11201400B	1	11201400B
A12	PWA DISPLAY 1120	04901	11200900A	1	11200900A
A13	PWA KEYBOARD 1120	04901	11201000A	1	11201000A
A14	POWER SWITCH ASSEMBLY	04901	11200600A	1	11200600A
A15	BRACKET CONN ASSY (INPUT)	04901	11200701A	1	11200701A
A16	BRACKET CONN ASSY (OUTPUT)	04901	11200702A	1	11200702A
A17	FRONT PANEL ASSY 1120	04901	11200401A	1	11200401A
A18	CARD CAGE ASSEMBLY 1120	04901	11201200A	1	11201200A
A19	REAR PANEL UNIT	04901	60335500B	1	60335500B
A20	HEAT SINK ASSY 1120/30	04901	08250801A	1	08250801A
A21	REAR PANEL ASSEMBLY	04901	11200801B	1	11200801B
A22	FRAME ASSEMBLY 1120	04901	11200201A	1	11200201A
A23	SUB PANEL ASSY 1120	04901	11200501A	1	11200501A

11200600A REV: BB POWER SWITCH ASSEMBLY
MODEL: 1120

REFERENCE DESIGNATOR	DESCRIPTION	FED. CODE	MANUFACTURER PART NUMBER	QTY	BEC PART NUMBER
S1	SWITCH ROCKER DPDT	13812	572-2121-0103-010	1	465286000
W17/W22	CABLE ASSY, POWER	04901	57123400A	1	57123400A

11200701A REV: A* BRACKET CONN ASSY (INPUT)
MODEL: 1120

REFERENCE DESIGNATOR	DESCRIPTION	FED. CODE	MANUFACTURER PART NUMBER	QTY	BEC PART NUMBER
J1	CONNECTOR BINDING POST GROUND	74970	111-2223-001	1	479454000
J2-3	CONN COAX BNC	54420	UG-625/U	2	479123000
W19	CABLE COAXIAL ASSY, INPUT	04901	57223901A	1	57223901A

11200702A REV: A* BRACKET CONN ASSY (OUTPUT)
MODEL: 1120

REFERENCE DESIGNATOR	DESCRIPTION	FED. CODE	MANUFACTURER PART NUMBER	QTY	BEC PART NUMBER
J4	CONNECTOR BINDING POST GROUND	74970	111-2223-001	1	479454000
J5-6	CONN COAX BNC	54420	UG-625/U	2	479123000
W29	CABLE COAXIAL ASSY (BLUE)	04901	57223604A	1	57223604A
W30	CABLE COAXIAL ASSY (YELLOW)	04901	57223605A	1	57223605A

11200401A REV: A* FRONT PANEL ASSEMBLY
MODEL: 1120

REFERENCE DESIGNATOR	DESCRIPTION	FED. CODE	MANUFACTURER PART NUMBER	QTY	BEC PART NUMBER
A13	PWA KEYBOARD 1120	04901	11201000A	1	11201000A
A23	SUB PANEL ASSEMBLY	04901	11200501A	1	11200501A

11201200A REV: C* CARD CAGE ASSEMBLY 1120
MODEL: 1120

REFERENCE DESIGNATOR	DESCRIPTION	FED. CODE	MANUFACTURER PART NUMBER	QTY	BEC PART NUMBER
A10	PWA MOTHER 1120	04901	11201500A	1	11201500A

60335500B REV: BB REAR PANEL UNIT
MODEL: 1120

REFERENCE DESIGNATOR	DESCRIPTION	FED. CODE	MANUFACTURER PART NUMBER	QTY	BEC PART NUMBER
S2	SWITCH DUAL SLIDE DPDT-DPDT	82389	47206LFR	1	465279000

08250801A REV: A* HEAT SINK ASSY 1120/30
MODEL: 1120/30

REFERENCE DESIGNATOR	DESCRIPTION	FED. CODE	MANUFACTURER PART NUMBER	QTY	BEC PART NUMBER
C20	CAP CER 0.01uF 20% 500V	33883	BGP Z5U W/FOCL	1	224271000
CR1	DIODE BRIDGE SDA-980-1	11961	SDA-980-1	1	532030000
U4	IC 323K REGULATOR	27014	LM323K	1	535024000
U5	IC UA7805UC VOLT REG	07263	uA7805UC	1	53511700A
U6	IC UA79M05AUC VOLT REG	07263	uA79M05AUC	1	535093000
W18	CABLE ASSY	04901	57121703A	1	57121703A
XU4	SOCKET TRANSISTOR PWR TO-3	06776	MP-3452G	1	47308000A

11200801B REV: B* REAR PANEL ASSEMBLY
MODEL: 1120

REFERENCE DESIGNATOR	DESCRIPTION	FED. CODE	MANUFACTURER PART NUMBER	QTY	BEC PART NUMBER
A19	REAR PANEL UNIT	04901	60335500B	1	60335500B
A20	HEAT SINK ASSY 1120/30	04901	08250801A	1	08250801A
F1	FUSE 0.75 AMP 250V MDL SLO BLO	54426	MDL-3/4	1	545533000
FL1	FILTER LINE	56289	3JX5421A	1	439004000
J7-12	CONN COAX BNC	54420	UG-625/U	6	479123000
T1	TRANSFORMER POWER	04901	44609600A	1	44609600A
W7	CABLE COAX ASSEMBLY (BLACK)	04901	57223602A	1	57223602A
W8	CABLE COAX ASSEMBLY (ORANGE)	04901	57223601A	1	57223601A
W9	CABLE COAX ASSEMBLY (VIOLET)	04901	57223603A	1	57223603A
W15	CABLE ASBY	04901	57121701A	1	57121701A
W20	CABLE ASSY, FLAT (GP18)	04901	57223002A	1	57223002A
W25	CABLE ASSEMBLY	04901	57122100A	1	57122100A
W38-39	CABLE ASSY	04901	57121801A	2	57121801A
W43	CABLE ASSY	04901	57120100B	1	57120100B

11200501A REV: B* SUB PANEL ASSEMBLY
MODEL: 1120

REFERENCE DESIGNATOR	DESCRIPTION	FED. CODE	MANUFACTURER PART NUMBER	QTY	BEC PART NUMBER
A12	PWA DISPLAY 1120	04901	11200900A	1	11200900A
A14	POWER SWITCH ASSEMBLY	04901	11200600A	1	11200600A
A15	BRACKET CONN ASSY (INPUT)	04901	11200701A	1	11200701A
A16	BRACKET CONN ASSY (OUTPUT)	04901	11200702A	1	11200702A

REFERENCE DESIGNATOR	DESCRIPTION	FED. CODE	MANUFACTURER PART NUMBER	QTY	BEC PART NUMBER
C1-2	CAPACITOR MATCHED PAIR	04901	23418000A	2	23418000A
C3-4	CAP MICA 20pF 5% 300V	14655	CD5CC200J	2	205017000
C5	CAP VAR CER 5-25pF 250V VIO	91293	9374	1	281021000
C6	CAP CER 8.2pF +-0.5pF 500V	TUSONI	301-000-A2ND-829D	1	224322000
C7-8	CAP MICA 680pF 1% 300V	14655	CD15FC681F03	2	200015000
C9	CAP CER 8.2pF +-0.5pF 500V	TUSONI	301-000-A2ND-829D	1	224322000
C10	CAP VAR CER 5-25pF 250V VIO	91293	9374	1	281021000
C11-12	CAP CER 0.02uF 20% 500V	51406	GP5-203MF	2	224118000
C13-14	CAP MICA 12pF 5% 300V	57582	K05120J301	2	205005000
C15-16	CAP CER 0.1uF 20% 50V	04222	SR215E104MAA	2	224268000
C17	CAP MICA 10pF 5% 300V	14655	CD5WCC100J	1	205002000
C18	CAP TANT 1.0uF 10% 35V ONLY	56289	196D105X9035MA1	1	283216000
C21-22	CAP CER 8.2pF +-0.5pF 500V	TUSONI	301-000-R2ND-829D	2	224322000
C23-24	CAP CER 33pF 5% 1000V	56289	10TCC-Q33	2	224139000
C25	CAP MICA 56pF 5% 300V	14655	CD5EC560J	1	205031000
C26-27	CAP EL 100uF 20% 25V	84217	SM-25-V8-100-M	2	283334000
C28	CAP MICA 27pF 5% 300V	14655	CD5EC270J	1	205008000
C29	CAP MICA 33pF 5% 300V	20307	DM5-EC330J	1	205010000
C30	CAP MICA 130pF 5% 100V	14655	CD5FA131J	1	205011000
C31	CAP MICA 33pF 5% 300V	20307	DM5-EC330J	1	205010000
C32-33	CAP VAR CER 6-70pF	91293	9315	2	281010000
CR1-6	DIODE SIG 1N914	01295	1N914	6	530058000
CR7-10	DIODE SIG FDH-300	07263	FDH300	4	530052000
CR13	DIODE SIG 1N914	01295	1N914	1	530058000
F1-2	FUSE 1/16 AMP 220V SLO BLO	54426	MOL 1/16	2	545518000
J19	HEADER 4 PIN STRAIGHT	06383	HPSS156-4-C	1	477344000
K1-2	RELAY FORM "A"	15636	RA3080-1051	2	471033000
K3-9	RELAY REED 15V PSEUDO FORM "C"	WABASH	1632-3-1	7	47104800A
L1-2	INDUCTOR 5.6uH 10%	24226	15/561	2	400308000
L3-4	FERRITE BEADS	34899	2643000101	2	483247000
Q1-6	TRANS NPN 2N3904	04713	2N3904	6	528071000
R1-2	RES COMP 10K 5% 1W	01121	8C1035	2	302125000
R3-4	RES MF 99K 0.1% 2W 25ppm	03888	PME75 T-2	2	32676200A
R5-6	RES MF 1K 0.1% 1/8W	64537	PME55-T2	2	324241000
R7	RES VAR 20 OHM 20% 0.5W	73138	72XWA20	1	311397000
R8-9	RES MF 90K 0.1% 1/2W 25ppm	03888	PME65 T-2	2	32676100A
R10-11	RES MF 11K 0.1% 1/8W	03888	PME55 T-2	2	32592300A
R12	RES VAR 200 OHM 10% 0.5W	73138	72XWR200	1	311339000
R13-14	RES COMP 10K 5% 1W	01121	8G1035	2	302125000
R15-16	RES MF 100K 0.1% 1/2W 25ppm	03888	PME65 T-2	2	32676300A
R17-18	RES MF 2K 0.1% 1/8W	64537	PME55 T-0	2	324275000
R19-21	RES MF 4K 0.1% 1/8W	64537	PME55 T-0	3	324313000
R22	RES MF 8K 0.1% 1/8W	03888	PME55 T-2	1	32592400A
R23-24	RES MF 10.0K 1% 1/4W	19701	5043ED10K00F	2	341400000
R25-27	RES MF 5.00K 0.1% 1/8W	64537	PME55-T2	3	324326000
R28	RES MF 4.95K 0.1% 1/8W	03888	PME55 T-2	1	32592500A
R29	RES VAR 100 OHM 10% 0.5W	73138	72XWA100	1	311306000
R30	RES MF 10.0K 1% 1/4W	19701	5043ED10K00F	1	341400000
R31	RES MF 5.00K 0.1% 1/8W	64537	PME55-T2	1	324326000
R34-35	RES MF 4.99K 1% 1/4W	19701	5043ED4K990F	2	341367000
R36	RES MF 20.0K 1% 1/4W	19701	5043ED20K00F	1	341429000
R37-42	RES MF 2.00K 1% 1/4W	19701	5043ED2K000F	6	341329000
R43-44	RES MF 1.00K 1% 1/4W	19701	5043ED1K000F	2	341300000
R45-46	RES COMP 20M 5% 1/4W	01121	CB2065	2	343729000
TP1-6	TERMINAL WIRE LOOP TEST POINT	31313	TP-103-02	6	48330600A
U1	IC 74LS74 FLIP FLOP	01295	SN74LS74N	1	534157000
U2	IC 74LS273 OCTAL D FLIPFLOP	01295	SN74LS273N	1	534263000
U3	IC 78L05 VOLT REG	07263	uA78L05AWC	1	535044000
U4	IC 13333 ANALOG SWITCH LF	27014	LF13333N	1	535095000
U5	IC 5534AN OP AMP	18324	NE553AN	1	535061000
U6	IC 339 QUAD COMPARATOR	27014	LM339N	1	535018000
U7	IC TL072BCP DUAL OP AMP	01295	TL072BCP	1	535102000
U8-9	IC 5534AN OP AMP	18324	NE553AN	2	535061000
XF1-4	FUSE CLIP	54426	1A-1119-10	4	482110000
XU1	SOCKET IC 14 PIN	06776	ICN-143-S3-G	1	473019000
XU2	SOCKET IC 20 PIN	06776	ICN-203-S3-G	1	473065000
XU4	SOCKET IC 16 PIN	06776	ICN-163-S3-G	1	473042000
XU5	SOCKET IC 8 PIN	06776	ICN-083-S3-G	1	473041000
XU6	SOCKET IC 14 PIN	06776	ICN-143-S3-G	1	473019000
XU7-9	SOCKET IC 8 PIN	06776	ICN-083-S3-G	3	473041000

11203500A REV: AA PWA MAIN FILTER 1120/30
MODEL: 1120/30

REFERENCE DESIGNATOR	DESCRIPTION	FED. CODE	MANUFACTURER PART NUMBER	QTY	BEC PART NUMBER
C1-2	CAP EL 100uF 20% 25V	54217	SM-25-V8-100-M	2	283334000
C3	CAP MICA 10pF 5% 300V	14655	CD5WCC100J	1	205002000
C4-6	CAP CER 0.1uF 20% 50V	04222	SR215E104MAA	3	224268000
C7	CAP TANT 2.2uF 20% 35V	61637	T368B225M035ASC2513	1	283317000
C8	CAP CER 0.1uF 20% 50V	04222	SR215E104MAA	1	224268000
C9	CAP MICA 20pF 5% 300V	14655	CD5CG200J	1	205017000
C10-11	CAP EL 100uF 20% 25V	54217	SM-25-V8-100-M	2	283334000
C12	CAP CER 1.0uF 20% 50V	04222	SR305E105MAA	1	224264000
C19	CAP MICA 68pF 1% 300V	14655	CD5EC680F	1	20506001A
CR1-3	DIODE SIG 1N914	01295	1N914	3	530058000
CR4	DIODE ZENER 1N5227B 3.6V 5%	04713	1N5227B	1	530095000
L1-2	INDUCTOR 5.6uH 10%	24226	10/561	2	400408000
P1A-10A	SOCKET SPRING COMPONENT LEAD	32575	1-332070-7	10	479333000
P1B-10B	SOCKET SPRING COMPONENT LEAD	32575	1-332070-7	10	479333000
R1	RES MF 4.02K 1% 1/4W	19701	5043ED4K020F	1	341358000
R2	RES MF 3.000K .1% 1/8W	64537	PME55-T2	1	324300000
R3-4	RES MF 1K 0.1% 1/8W	64537	PME55-T2	2	324241000
R5-6	RES MF 2.00K 1% 1/4W	19701	5043ED2K000F	2	341329000
R7	RES MF 4.99K 1% 1/4W	19701	5043ED4K990F	1	341367000
TP1-6	TERMINAL WIRE LOOP TEST POINT	31313	TP101-10	6	483258000
U1	IC 5534AN OP AMP	18324	NE553AN	1	535061000
U2	IC 13201N ANALOG SWITCH	27014	LF13201N	1	535106000
U3	IC 74LS273 OCTAL D FLIPFLOP	01295	SN74LS273N	1	534263000
U4	IC 74LS139 DECODE/MULTPXR	01295	SN74LS139N	1	534188000
U5	IC HA3-2625-5-M OP AMP	34371	HA3-2625-5	1	53511900A
U6	IC AD536 TRUE RMS/DC CONV	51640	AD536AJD	1	535105000
U7	IC 13201N ANALOG SWITCH	27014	LF13201N	1	535106000
U8	IC 5534AN OP AMP	18324	NE553AN	1	535061000
U9	IC 78L05 VOLT REG	07263	uA78L05AWC	1	535044000
XU1	SOCKET IC 8 PIN	06776	ICN-083-S3-G	1	473041000
XU2	SOCKET IC 16 PIN	06776	ICN-163-S3-G	1	473042000
XU3	SOCKET IC 20 PIN	06776	ICN-203-S3-G	1	473065000
XU4	SOCKET IC 16 PIN	06776	ICN-163-S3-G	1	473042000
XU5	SOCKET IC 8 PIN	06776	ICN-083-S3-G	1	473041000
XU6	SOCKET IC 14 PIN	06776	ICN-143-S3-G	1	473019000
XU7	SOCKET IC 16 PIN	06776	ICN-163-S3-G	1	473042000
XU8	SOCKET IC 8 PIN	06776	ICN-083-S3-G	1	473041000

11201700A REV: FB PWA NOTCH FILTER 1120
MODEL: 1120

REFERENCE DESIGNATOR	DESCRIPTION	FED. CODE	MANUFACTURER PART NUMBER	QTY	BEC PART NUMBER
C1-2	CAP CER 0.1uF 20% 50V	04222	SR215E104MAA	2	224268000
C3	CAP MICA 220pF 1% 50V	14655	CD5FY221F	1	20505900A
C4	CAP MPC 0.47uF 1% 50V	27735	MPC-53-0.47-50-1	1	23417500A
C5	CAP MPC 0.047uF 1% 50V	27735	MPC-53-.047-50-1	1	23417400A
C6	CAP MICA 8200pF 1% 100V	14655	CD19FA822F	1	200532000
C7	CAP MICA 680pF 1% 300V	14655	CD15FC681F03	1	200015000
C8-9	CAP CER 0.1uF 20% 50V	04222	SR215E104MAA	2	224268000
C10	CAP MICA 220pF 1% 50V	14655	CD5FY221F	1	20505900A
C11	CAP MPC 0.47uF 1% 50V	27735	MPC-53-0.47-50-1	1	23417500A
C12	CAP MPC 0.047uF 1% 50V	27735	MPC-53-.047-50-1	1	23417400A
C13	CAP MICA 8200pF 1% 100V	14655	CD19FA822F	1	200532000
CC14	CAP MICA 680pF 1% 300V	14655	CD15FC681F03	1	200015000
C15	CAP TANT 56uF 10% 6V	56289	196D566X9006KA1	1	283228000
C16	CAP TANT 15uF 10% 20V	56289	196D156X9020KA1	1	283227000
C17-18	CAP EL 100uF 20% 25V	54217	SM-25-V8-100-M	2	283334000
C19-22	CAP CER 0.1uF 20% 50V	04222	SR215E104MAA	4	224268000
C23	CAP MPC 0.047uF 1% 50V	27735	MPC-53-.047-50-1	1	23417400A
C24-25	CAP MPC 0.33uF 10% 100V	19701	71981CD334PK10158	2	234162000
C26	CAP MPC 0.047uF 1% 50V	27735	MPC-53-.047-50-1	1	23417400A
C27	CAP CER 0.1uF 20% 50V	04222	SR215E104MAA	1	224268000
C28	CAP CER 1.0uF 20% 50V	04222	SR305E105MAA	1	224264000
C29-30	CAP CER 0.02uF 20% 500V	51406	CP5-203MF	2	224118000
C31-32	CAP MPC 0.01uF 2% 50V	14752	652A-1A-103C	2	234142000

REFERENCE DESIGNATOR	DESCRIPTION	FED. CODE	MANUFACTURER PART NUMBER	QTY	BEC PART NUMBER
L1-2	INDUCTOR 5.6uH 10%	24226	10/561	2	400408000
Q1-8	TRANS FET 2N5653 MOTOROLA ONLY	04713	2N5653	8	52816000A
Q9-12	TRANS FET J108	17856	J-108	4	52815600A
Q13-20	TRANS FET 2N5653 MOTOROLA ONLY	04713	2N5653	8	52816000A
Q21-24	TRANS FET J108	17856	J-108	4	52815600A
Q25-26	TRANS FET PN4391	27014	PN4391	2	52815900A
R1-2	RES MF 20.0K 1% 1/4W	19701	5043ED20K00F	2	341429000
R3	RES MF 10.0K 1% 1/4W	19701	5043ED10K00F	1	341400000
R4	RES MF 8.25K 1% 1/4W	19701	5043ED8K250F	1	341388000
R5	RES MF 10.0K 1% 1/4W	19701	5043ED10K00F	1	341400000
R6	RES MF 9.95K 0.1% 1/8W	03888	PME55 TO	1	32591700A
R7	RES MF 20.0K 0.1% 1/8W	03888	PME55 TO	1	32591800A
R8	RES MF 40.0K 0.1% 1/8W	03888	PME55 TO	1	32591900A
R9	RES MF 80.0K 0.1% 1/8W	03888	PME55 TO	1	32592000A
R10	RES MF 160.0K 0.1% 1/8W	03888	PME55 TO	1	32592100A
R11	RES MF 320.0K 0.1% 1/8W	03888	PME55 TO	1	32592200A
R12	RES MF 640K 0.1% 1/8W	03888	PME55 TO	1	32593000A
R13	RES COMP 1.2M 5% 1/4W	01121	CB1255	1	343608000
R14-18	RES MF 4.99K 1% 1/4W	19701	5043ED4K990F	5	341367000
R19	RES MF 9.95K 0.1% 1/8W	03888	PME55 TO	1	32591700A
R20	RES MF 20.0K 0.1% 1/8W	03888	PME55 TO	1	32591800A
R21	RES MF 40.0K 0.1% 1/8W	03888	PME55 TO	1	32591900A
R22	RES MF 80.0K 0.1% 1/8W	03888	PME55 TO	1	32592000A
R23	RES MF 160.0K 0.1% 1/8W	03888	PME55 TO	1	32592100A
R24	RES MF 320.0K 0.1% 1/8W	03888	PME55 TO	1	32592200A
R25	RES MF 640K 0.1% 1/8W	03888	PME55 TO	1	32593000A
RR26	RES COMP 1.2M 5% 1/4W	01121	CB1255	1	343608000
R27	RES MF 2.00K 1% 1/4W	19701	5043ED2K000F	1	341329000
R28	RES MF 20.0K 1% 1/4W	19701	5043ED20K00F	1	341429000
R29	RES MF 2.00K 1% 1/4W	19701	5043ED2K000F	1	341329000
R30-31	RES MF 4.99K 1% 1/4W	19701	5043ED4K990F	2	341367000
R32	RES MF 1.00K 1% 1/4W	19701	5043ED1K000F	1	341300000
R33	RES MF 10.0K 1% 1/4W	19701	5043ED10K00F	1	341400000
R34	RES MF 49.9K 1% 1/4W	19701	5043ED49K90F	1	341467000
R35	RES MF 4.99K 1% 1/4W	19701	5043ED4K990F	1	341367000
R36-37	RES MF 10.0K 1% 1/4W	19701	5043ED10K00F	2	341400000
R38-39	RES MF 1.00K 1% 1/4W	19701	5043ED1K000F	2	341300000
R40	RES MF 48.7K 1% 1/4W	19701	5043ED48K70F	1	341466000
R41-42	RES MF 100K 1% 1/4W	19701	5043ED100K0F	2	341500000
R43	RES MF 48.7K 1% 1/4W	19701	5043ED48K70F	1	341466000
R44	RES MF 100K 1% 1/4W	19701	5043ED100K0F	1	341500000
R45	RES MF 10.0 OHM 1% 1/4W	19701	5043ED10R00F	1	341100000
R46	RES VAR 20K 10% 0.5W	73138	82PAR20K	1	311374000
R47	RES MF 10.0 OHM 1% 1/4W	19701	5043ED10R00F	1	341100000
R48	RES MF 100K 1% 1/4W	19701	5043ED100K0F	1	341500000
R49	RES VAR 20K 10% 0.5W	73138	82PAR20K	1	311374000
R50-51	RES MF 10.0K 1% 1/4W	19701	5043ED10K00F	2	341400000
R52	RES MF 4.99K 1% 1/4W	19701	5043ED4K990F	1	341367000
R53-55	RES MF 49.9K 1% 1/4W	19701	5043ED49K90F	3	341467000
R56-57	RES MF 68.1K 1% 1/4W	19701	5043ED68K10F	2	341480000
R58-59	RES NETWORK 100K 2% 1.5W	71450	750-61-R100K	2	345032000
R60-61	RES MF 100K 1% 1/4W	19701	5043ED100K0F	2	341500000
R62-63	RES MF 49.9K 1% 1/4W	19701	5043ED49K90F	2	341467000
R64	RES MF 28.0K 1% 1/4W	19701	5043ED28K00F	1	341443000
R65	RES MF 49.9K 1% 1/4W	19701	5043ED49K90F	1	341467000
R66-68	RES NETWORK 3.3K 2% 0.9W	71450	750-61-R3.3K	3	34504500A
R69	RES MF 3.32K 1% 1/4W	19701	5043ED3K320F	1	341350000
R70	RES MF 1.50K 1% 1/4W	19701	5043ED1K500F	1	341317000
U1-5	IC 5532 OP-AMP	18324	NE5532AN	5	53513500A
U6	IC 393 OP AMP	27014	LM393N	1	535107000
U7	IC OP-07EP OP AMP	06665	OP-07EP	1	535110000
U8	IC 13201N ANALOG SWITCH	27014	LF13201N	1	535106000
U9	IC OP-07EP OP AMP	06665	OP-07EP	1	535110000
U10-11	IC 4200ADE ANALOG MULTIPLIER	49956	RC4200ADE	2	53508301A
U12	IC 78L05 VOLT REG	07263	uA78L05AWC	1	535044000
U13	IC 13333 ANALOG SWITCH LF	27014	LF13333N	1	535095000
U14-16	IC 339 QUAD COMPARATOR	27014	LM339N	3	535018000
U17-18	IC 74LS273 OCTAL D FLIPFLOP	01295	SN74LS273N	2	534263000
XU1-7	SOCKET IC 8 PIN	06776	ICN-083-S3-G	7	473041000
XU8	SOCKET IC 16 PIN	06776	ICN-163-S3-G	1	473042000
XU9-11	SOCKET IC 8 PIN	06776	ICN-083-S3-G	3	473041000
XU13	SOCKET IC 16 PIN	06776	ICN-163-S3-G	1	473042000
XU14-16	SOCKET IC 14 PIN	06776	ICN-143-S3-G	3	473019000
XU17-18	SOCKET IC 20 PIN	06776	ICN-203-S3-G	2	473065000

REFERENCE DESIGNATOR	DESCRIPTION	FED. CODE	MANUFACTURER PART NUMBER	QTY	BEC PART NUMBER
C1	CAP TANT 56uF 10% 6V	56289	1960566X9006KA1	1	283228000
C2	CAP TANT 15uF 10% 20V	56289	1960156X9020KA1	1	283227000
C3	CAP MICA 3.0pF +-0.5pF 300V	14655	C05CC0300	1	205013000
C4	CAP TANT 56uF 10% 6V	56289	1960566X9006KA1	1	283228000
C5-6	CAP CER 0.1uF 20% 50V	04222	SR215E104MAA	2	224268000
C7	CAP MICA 3.0pF +-0.5pF 300V	14655	C05CC0300	1	205013000
C8	CAP MICA 1000pF 1% 100V	51406	DM15-102F	1	200113000
C9	CAP MICA 500pF 1% 500V	14655	CD15F0501F	1	200123000
C11	CAP MICA 130pF 5% 100V	14655	C05FA131J	1	205011000
C12	CAP MICA 500pF 1% 500V	14655	CD15F0501F	1	200123000
C13	CAP MICA 250pF 1% 50V	14655	C05FY251F	1	205034000
C14	CAP MICA 56pF 1% 300V	57582	K05560F301	1	205053000
C15	CAP MICA 91pF 1% 300V	14655	C05FC910F	1	205033000
C16	CAP MICA 47pF 1% 300V	57582	K05470F301	1	205052000
C17	CAP MICA 10pF 5% 300V	14655	C05WCG100J	1	205002000
C18	CAP MICA 120pF 1% 50V	20307	DM5-FY121F	1	205050000
C19	CAP MICA 68pF 1% 300V	14655	C05EC680F	1	20506001A
C20-21	CAP MPC 0.22uF 2% 50V	14752	652A-1-A224G	2	234167000
C22	CAP TANT 56uF 10% 6V	56289	1960566X9006KA1	1	283228000
C23	CAP TANT 1.0uF 10% 35V ONLY	56289	196D105X9035NA1	1	283216000
C24-33	CAP CER 0.1uF 20% 50V	04222	SR215E104MAA	10	224268000
C34	CAP CER 1.0uF 20% 50V	04222	SR305E105MAA	1	224264000
C35-38	CAP CER 0.1uF 20% 50V	04222	SR215E104MAA	4	224268000
C39-40	CAP EL 100uF 20% 25V	54217	SM-25-V8-100-M	2	283334000
CR1-5	DIODE SIG 1N914	01295	1N914	5	530058000
CR6-7	DIODE ZENER 1N5230B 4.7V 5%	04713	1N5230B	2	530103000
CR8-11	DIODE SIG 1N914	01295	1N914	4	530058000
CR12	DIODE ZENER 1N5240B 10V 5%	04713	1N5240B	1	530077000
K1	RELAY DIP DPST 5V FORM "C"	95348	835C-1	1	471034000
L1-2	INDUCTOR 5.6uH 10%	24226	10/561	2	400408000
R1-2	RES MF 1.00K 1% 1/4W	19701	5043ED1K000F	2	341300000
R3	RES MF 9K 0.1% 1/4W	64537	PME55-T2	1	324354000
R4-5	RES MF 1K 0.1% 1/8W	64537	PME55-T2	2	324241000
R6	RES MF 9K 0.1% 1/4W	64537	PME55-T2	1	324354000
R7	RES MF 5.00K 0.1% 1/8W	64537	PME55-T2	1	324326000
R8	RES MF 3.000K .1% 1/8W	64537	PME55-T2	1	324300000
R9-11	RES MF 1K 0.1% 1/8W	64537	PME55-T2	3	324241000
R12	RES MF 9K 0.1% 1/4W	64537	PME55-T2	1	324354000
R13	RES MF 10.0K 1% 1/4W	19701	5043ED10K00F	1	341400000
R14	RES MF 3.32K 1% 1/4W	19701	5043ED3K320F	1	341350000
R15	RES MF 13.3K 1% 1/4W	19701	5043ED13K30F	1	341412000
R16	RES MF 17.8K 1% 1/4W	19701	5043ED17K80F	1	341424000
R17	RES MF 2.43K 1% 1/4W	19701	RN55D-2431-F	1	341337000
R18	RES MF 10.0K 1% 1/4W	19701	5043ED10K00F	1	341400000
R19	RES MF 13.3K 1% 1/4W	19701	5043ED13K30F	1	341412000
R20	RES MF 2.43K 1% 1/4W	19701	RN55D-2431-F	1	341337000
R21	RES MF 10.0K 1% 1/4W	19701	5043ED10K00F	1	341400000
R22	RES MF 11.5K 1% 1/4W	19701	5043ED11K50F	1	341406000
R23	RES MF 2.43K 1% 1/4W	19701	RN55D-2431-F	1	341337000
R24	RES MF 2.00K 1% 1/4W	19701	5043ED2K000F	1	341329000
R25	RES MF 374K 1% 1/4W	19701	5043ED374K0F	1	341555000
R26	RES MF 75.0K 1% 1/4W	19701	5043ED75K00F	1	341484000
R27	RES MF 600 OHM 0.25% 1/8W	64537	PME55-T2	1	324215000
R28	RES MF 1.00K 1% 1/4W	19701	5043ED1K000F	1	341300000
R29	RES MF 2.00K 1% 1/4W	19701	5043ED2K000F	1	341329000
R30	RES MF 200K 1% 1/4W	19701	5043ED200K0F	1	341529000
R31	RES MF 100K 1% 1/4W	19701	5043ED100K0F	1	341500000
R32-33	RES MF 10.0K 1% 1/4W	19701	5043ED10K00F	2	341400000
U1	IC 13333 ANALOG SWITCH LF	27014	LF13333N	1	535095000
U2	IC HA3-2625-5-M OP AMP	34371	HA3-2625-5	1	53511900A
U3	IC 13201N ANALOG SWITCH	27014	LF13201N	1	535106000
U4	IC HA3-2625-5-M OP AMP	34371	HA3-2625-5	1	53511900A
U5	IC 13201N ANALOG SWITCH	27014	LF13201N	1	535106000
U6-7	IC 5532A DUAL OP AMP 8 DIP	01295	NE5532AP	2	53512100A
U8	IC AD536 TRUE RMS/DC CONV	51640	AD536AJD	1	535105000
U9	IC 74LS273 OCTAL D FLIPFLOP	01295	SN74LS273N	1	534263000
U10	IC 74LS139 DECODE/MULTPXR	01295	SN74LS139N	1	534188000
U11	IC 78L05 VOLT REG	07263	uA78L05AWG	1	535044000
XU1	SOCKET IC 16 PIN	06776	ICN-163-S3-G	1	473042000
XU2	SOCKET IC 8 PIN	06776	ICN-083-S3-G	1	473041000
XU3	SOCKET IC 16 PIN	06776	ICN-163-S3-G	1	473042000
XU4	SOCKET IC 8 PIN	06776	ICN-083-S3-G	1	473041000
XU5	SOCKET IC 16 PIN	06776	ICN-163-S3-G	1	473042000
XU6-7	SOCKET IC 8 PIN	06776	ICN-083-S3-G	2	473041000
XU8	SOCKET IC 14 PIN	06776	ICN-143-S3-G	1	473019000
XU9	SOCKET IC 20 PIN	06776	ICN-203-S3-G	1	473065000
XU10	SOCKET IC 16 PIN	06776	ICN-163-S3-G	1	473042000

REFERENCE DESIGNATOR	DESCRIPTION	FED. CODE	MANUFACTURER PART NUMBER	QTY	BEC PART NUMBER
C1	CAP CER 0.1uF 20% 50V	04222	SR215E104MAA	1	224268000
C2	CAP EL 100uF 20% 25V	54217	SM-25-VB-100-M	1	283334000
C3-9	CAP CER 0.1uF 20% 50V	04222	SR215E104MAA	7	224268000
C10-12	CAP EL 100uF 20% 25V	54217	SM-25-VB-100-M	3	283334000
C13	CAP CER 0.1uF 20% 50V	04222	SR215E104MAA	1	224268000
C14	CAP NPC 0.0022uF 2% 50V	14752	653A-1-A222C	1	234165000
C15	CAP CER 3900pF 10% 100V	61637	C052K392K1X5CA	1	224319000
C16	CAP CER 560pF 10% 200V	61637	C052K561K2X5CA	1	224290000
C17	CAP TANT 4.7uF 10% 10V	56289	196D475X9010HA1	1	283226000
C18-22	CAP CER 0.1uF 20% 50V	04222	SR215E104MAA	5	224268000
C23	CAP EL 100uF 20% 25V	54217	SM-25-VB-100-M	1	283334000
C24	CAP CER 0.1uF 20% 50V	04222	SR215E104MAA	1	224268000
C25	CAP MICA 250pF 5% 50V	57582	K0251J101	1	205037000
C26-27	CAP TANT 2.2uF 20% 35V	61637	T368B225M035ASC2513	2	283317000
CR1-9	DIODE SIG 1N914	01295	1N914	9	530058000
CR10-11	DIODE SIG FDH-300	07263	FDH300	2	530052000
CR12-13	DIODE SIG 1N914	01295	1N914	2	530058000
CR14	DIODE ZENER 1N5231B 5.1V 5%	04713	1N5231BS2	1	530169000
DS1	LED RED DIFF 5082-4684	28480	HLMP-1301	1	536024000
DS2-5	LED RED DIFF HLMP-6620	28480	HLMP-6620	4	536026000
L1	INDUCTOR VK200/19-4B	02114	VK200/19-4B	1	400410000
L2-3	INDUCTOR 5.6uH 10%	24226	15/561	2	400308000
Q1	DIODE ZENER 1N5245B 15V 5%	04713	1N5245B	1	530076000
R1	RES MF 215 OHM 1% 1/4W	19701	5043ED215R0F	1	341232000
R2	RES MF 332 OHM 1% 1/4W	19701	5043ED332R0F	1	341250000
R3	RES MF 499 OHM 1% 1/4W	19701	5043ED499R0F	1	341267000
R4	RES MF 10.0K 1% 1/4W	19701	5043ED10K00F	1	341400000
R5	RES MF 1.47K 1% 1/4W	19701	5043ED1K470F	1	341316000
R6-7	RES MF 10.0K 1% 1/4W	19701	5043ED10K00F	2	341400000
R8-10	RES MF 1.00K 1% 1/4W	19701	5043ED1K000F	3	341300000
R11-12	RES MF 10.0K 1% 1/4W	19701	5043ED10K00F	2	341400000
R13	RES MF 1.47K 1% 1/4W	19701	5043ED1K470F	1	341316000
R14	RES NETWORK 3K/6.2K 2% 2.7W	73138	785-5-R3K/6.2K	1	345031000
R15-19	RES MF 4.99K 1% 1/4W	19701	5043ED4K990F	5	341367000
R20-21	RES MF 1.47K 1% 1/4W	19701	5043ED1K470F	2	341316000
R22-23	RES MF 1.00K 1% 1/4W	19701	5043ED1K000F	2	341300000
R24	RES MF 2.00K 1% 1/4W	19701	5043ED2K000F	1	341329000
R25-26	RES MF 1.00K 1% 1/4W	19701	5043ED1K000F	2	341300000
R27	RES MF 56.2K 1% 1/4W	19701	5043ED56K20F	1	341472000
R28	RES MF 5.00K 0.1% 1/8W	64537	PME55-T2	1	324326000
R29	RES MF 1.00K 1% 1/4W	19701	5043ED1K000F	1	341300000
R30	RES MF 2.00K 1% 1/4W	19701	5043ED2K000F	1	341329000
R31	RES MF 1.47K 1% 1/4W	19701	5043ED1K470F	1	341316000
R32	RES MF 100 OHM 1% 1/4W	19701	5043ED100R0F	1	341200000
S1	SWITCH ROCKER (8 SW)	81073	76SB08B	1	465283000
TP1-12	TERMINAL WIRE LOOP TEST POINT	31313	TP-103-02	12	48330600A
U1	IC 393 OP AMP	27014	LM393N	1	535107000
U2	IC 74LS04 HEX INVERTER	01295	SN74LS04N	1	534155000
U3-4	IC 74LS00 2 INP POS NAND	01295	SN74LS00N	2	534167000
U5	IC 74F151PC	07263	74F151PC	1	534374000
U6-8	IC 74LS490 DUAL DEC COUNTER	18324	N74LS490N	3	534238000
U9	IC 74F151PC	07263	74F151PC	1	534374000
U10	IC 74F74PC DUAL D FLIP FLOP	07263	74F74PC	1	534367000
U11	IC 74LS138 DECOD/MPX	01295	SN74LS138N	1	534246000
U12	IC 74F74PC DUAL D FLIP FLOP	07263	74F74PC	1	534367000
U13-14	IC 8255APC PERIPH INTERFACE	34335	AM8255APC	2	534171000
U15-16	IC 4040B COUNTER/DIVIDER	02735	CD4040BE	2	534275000
U17	IC 393 OP AMP	27014	LM393N	1	535107000
U18	IC 5532A DUAL OP AMP 8 DIP	01295	NE5532AP	1	53512100A
U19	IC AD7549JN DUAL 12 BIT DAC	24355	AD7549JN	1	53512700A
U20	IC REF-02-CZ 5 VOLT REFERENCE	06665	PMI REF-12CZ	1	53512900A
U21	IC AD7582KN 12 BIT A/D	24355	AD7582KN	1	53512800A
XS1	SOCKET IC 16 PIN	06776	ICN-163-S3-G	1	473042000
XU1	SOCKET IC 8 PIN	06776	ICN-083-S3-G	1	473041000
XU2-4	SOCKET IC 14 PIN	06776	ICN-143-S3-G	3	473019000
XU5-9	SOCKET IC 16 PIN	06776	ICN-163-S3-G	5	473042000
XU10	SOCKET IC 14 PIN	06776	ICN-143-S3-G	1	473019000
XU11	SOCKET IC 16 PIN	06776	ICN-163-S3-G	1	473042000
XU12	SOCKET IC 14 PIN	06776	ICN-143-S3-G	1	473019000
XU13-14	SOCKET IC 40 PIN	06776	ICN-406-S4-TG	2	473052000
XU15-16	SOCKET IC 16 PIN	06776	ICN-163-S3-G	2	473042000
XU17-18	SOCKET IC 8 PIN	06776	ICN-083-S3-G	2	473041000
XU19	SOCKET IC 20 PIN	06776	ICN-203-S3-G	1	473065000
XU20	SOCKET IC 8 PIN	06776	ICN-083-S3-G	1	473041000
XU21	SOCKET IC 28 PIN	06776	ICN-286-S4-TG	1	473044000

11202000A REV: G* PWA CPU 1120
MODEL: 1120

REFERENCE DESIGNATOR	DESCRIPTION	FED. CODE	MANUFACTURER PART NUMBER	QTY	BEC PART NUMBER
B1	CELL LITHIUM 3V	54473	BR2325-1HB	1	556007000
C1-6	CAP CER 0.1uF 20% 50V	04222	SR215E104MAA	6	224268000
C7	CAP TANT 15uF 10% 20V	56289	196D156X9020KA1	1	283227000
C8-9	CAP CER 0.1uF 20% 50V	04222	SR215E104MAA	2	224268000
C10	CAP TANT 15uF 10% 20V	56289	196D156X9020KA1	1	283227000
C11-15	CAP CER 0.1uF 20% 50V	04222	SR215E104MAA	5	224268000
C16	CAP EL 100uF 20% 25V	54217	SM-25-VB-100-M	1	283334000
CR1-3	DIODE SIG 1N914	01295	1N914	3	530058000
J20-21	SOCKET IC 24 PIN	06776	ICN-246-S4-C	2	473043000
L1	INDUCTOR VK200/19-4B	02114	VK200/19-4B	1	400410000
Q1	TRANS NPN 2N3904	04713	2N3904	1	528071000
R1	RES MF 100K 1% 1/4W	19701	5043ED100K0F	1	341500000
R2	RES MF 332 OHM 1% 1/4W	19701	5043EO332R0F	1	341250000
R3	RES MF 10.0K 1% 1/4W	19701	5043ED10K00F	1	341400000
R4	RES MF 100K 1% 1/4W	19701	5043ED100K0F	1	341500000
R5	RES MF 22.1K 1% 1/4W	19701	RN55D-2212-F	1	341433000
R6	RES MF 100K 1% 1/4W	19701	5043ED100K0F	1	341500000
R7	RES NETWORK 3K/6.2K 2% 1.5W	73138	783-5-R3K/6.2K	1	345033000
R8-9	RES NETWORK 3K/6.2K 2% 2.7W	73138	785-5-R3K/6.2K	2	345031000
TP1-9	TERMINAL WIRE LOOP TEST POINT	31313	TP-103-02	9	48330600A
U1	IC 74LS04 HEX INVERTER	01295	SN74LS04N	1	534155000
U2	IC 74LS32 QUAD 2 INPUT OR	01295	SN74LS32N	1	534168000
U3-4	IC 8304BN 8 BIT TRI ST TRANS	27014	DP8304BN	2	534251000
U5	IC 4066A CMOS BILAT SW	02735	CD4066AE	1	534078000
U6	IC 4023B COS/MOS NAND	02735	CD4023AE	1	534143000
U7	IC Z80 MICROPRCS 6 MHz CMOS	56708	Z84C00-06PE	1	53440906A
U8-10	IC 74LS541 OCTAL BUFFER	01295	SN74LS541N	3	534381000
U11	IC 5564 8Kx8 RAM CMOS 28 DIP	TOSHIB	TC5564PL-15	1	534403000
U12	IC 74LS32 QUAD 2 INPUT OR	01295	SN74LS32N	1	534168000
U13	IC 74F74PC DUAL D FLIP FLOP	07263	74F74PC	1	534367000
U14	PROM 1120 A5 U14 CPU PWA	04901	53445700C	1	53445700C
U15	IC 74LS138 DECDR/MPX	01295	SN74LS138N	1	534246000
U16	IC 9914ANL IEEE BUS PROCESSOR	01295	TMS9914ANL	1	534288000
U17	IC 75160 IEEE BUS TRANSCEIVER	01295	SN75160BN	1	534286000
U18	IC 75161 IEEE BUS TRANSCEIVER	01295	SN75161BN	1	534287000
XU1-2	SOCKET IC 14 PIN	06776	ICN-143-S3-G	2	473019000
XU3-4	SOCKET IC 20 PIN	06776	ICN-203-S3-G	2	473065000
XU5-6	SOCKET IC 14 PIN	06776	ICN-143-S3-G	2	473019000
XU7	SOCKET IC 40 PIN	06776	ICN-406-S4-TG	1	473052000
XU8-10	SOCKET IC 20 PIN	06776	ICN-203-S3-G	3	473065000
XU11	SOCKET IC 28 PIN	06776	ICN-286-S4-TG	1	473044000
XU12-13	SOCKET IC 14 PIN	06776	ICN-143-S3-G	2	473019000
XU14	SOCKET IC 28 PIN	06776	ICN-286-S4-TG	1	473044000
XU15	SOCKET IC 16 PIN	06776	ICN-163-S3-G	1	473042000
XU16	SOCKET IC 40 PIN	06776	ICN-406-S4-TG	1	473052000
XU17-18	SOCKET IC 20 PIN	06776	ICN-203-S3-C	2	473065000
Y1	OSC CRYSTAL 10 MHz	27802	CO-251-816	1	547904000

11202100A REV: FD PWA SOURCE 1120
MODEL: 1120

REFERENCE DESIGNATOR	DESCRIPTION	FED. CODE	MANUFACTURER PART NUMBER	QTY	BEC PART NUMBER
C1	CAP CER 0.1uF 20% 50V	04222	SR215E104MAA	1	224268000
C2	CAP MPC 0.15uF 2% 50V	14752	652A-1-A-154C	1	234145000
C3	CAP CER 1.0uF 20% 50V	04222	SR305E105MAA	1	224264000
C4	CAP MPC 0.22uF 2% 50V	14752	652A-1-A224C	1	234167000
C5	CAP CER 0.022uF 10% 50V	61637	C052K223K5X5CA	1	224302000
C6	CAP TANT 4.7uF 10% 10V	56289	196D475X9010MA1	1	283226000
C7	CAP CER 1.0uF 20% 50V	04222	SR305E105MAA	1	224264000
C8-9	CAP EL 100uF 20% 25V	54217	SM-25-VB-100-M	2	283334000
C10	CAP CER 0.001uF 10% 100V	04222	SR151C102KAA	1	224270000
C11-12	CAP EL 100uF 20% 25V	54217	SM-25-VB-100-M	2	283334000
C13	CAP MICA 200pF 5% 100V	14655	CD5FA201J	1	205024000
C15	CAP MICA 8200pF 1% 100V	14655	CD19FA822F	1	200532000
C16	CAP MPC 0.047uF 1% 50V	27735	MPC-53-.047-50-1	1	23417400A
C17	CAP MPC 0.47uF 1% 50V	27735	MPC-53-0.47-50-1	1	23417500A
C18	CAP MICA 200pF 5% 100V	14655	CD5FA201J	1	205024000
C20	CAP MICA 8200pF 1% 100V	14655	CD19FA822F	1	200532000
C21	CAP MPC 0.047uF 1% 50V	27735	MPC-53-.047-50-1	1	23417400A
C22	CAP MPC 0.47uF 1% 50V	27735	MPC-53-0.47-50-1	1	23417500A

REFERENCE DESIGNATDR	DESCRIPTIDN	FED. CDDE	MANUFACTURER PART NUMBER	QTY	BEC PART NUMBER
C23	CAP CER 0.1uF 20% 50V	04222	SR215E104MAA	1	224268000
C24-27	CAP CER 1.0uF 20% 50V	D4222	SR305E105MAA	4	224264000
C28	CAP TANT 4.7uF 10% 10V	56289	196D475X9010HA1	1	283226000
C29	CAP MICA 100pF 5% 300V	20307	DM5-FC101J	1	205006000
C30	CAP EL 100uF 20% 25V	S4217	SM-25-V8-100-M	1	283334000
CR1	DIDDE SIG 1N914	01295	1N914	1	530058000
CR2	DIDDE ZENER 1N5227B 3.6V 5%	04713	1N5227B	1	530095000
CR3-4	DIDDE SIG 1N914	01295	1N914	2	530058000
CR5	DIDDE ZENER 1N5242B 12V 5%	04713	1N5242B	1	530146000
CR6-10	DIDDE SIG 1N914	D1295	1N914	5	530058000
CR11-12	DIDDE ZENER 1N5231B 5.1V 5%	D4713	1N5231BSZ	2	530169000
CR13-16	DIDDE SIG 1N914	01295	1N914	4	530058000
L1-2	INDUCTOR 5.6uH 10%	24226	10/561	2	400408000
Q1	TRANS FET PN4391	27014	PN4391	1	52815900A
Q2-5	TRANS FET J108	17856	J-108	4	52815600A
Q6-13	TRANS FET 2N5653 MDTDRDLA DNLY	04713	2N5653	8	52816000A
Q14-17	TRANS FET J108	17856	J-108	4	52815600A
Q18-25	TRANS FET 2N5653 MOTDRDLA DNLY	04713	2N5653	8	52816000A
R1	RES MF 2.21K 1% 1/4W	19701	5043ED2K210F	1	341333000
R2	RES VAR 1K 10% 0.5W	73138	82PAR1K	1	311370000
R3	RES MF 20.0K 1% 1/4W	19701	5D43ED20KD0F	1	341429000
R4	RES MF 7.50K 1% 1/4W	19701	5043ED7K500F	1	341384000
R5	RES MF 4.99K 1% 1/4W	19701	5043ED4K990F	1	341367000
R6	RES MF 6.19K 1% 1/4W	19701	5043ED6K190F	1	341376000
R7	RES MF 3.92K 1% 1/4W	19701	5043ED3K920F	1	341357000
R8	RES MF 100K 1% 1/4W	19701	5043ED100K0F	1	341500000
R10	RES MF 4.99K 1% 1/4W	19701	5043ED4K990F	1	341367000
R11	RES MF 20.0K 1% 1/4W	197D1	5043ED20K00F	1	341429000
R13	RES MF 4.99K 1% 1/4W	19701	5D43ED4K990F	1	341367000
R14-15	RES MF 68.1K 1% 1/4W	197D1	5D43ED68K10F	2	341480000
R16	RES MF 10.0K 1% 1/4W	19701	5043ED10K00F	1	341400000
R17	RES MF 2.49K 1% 1/4W	19701	5043ED2K490F	1	341338000
R18	RES MF 2.00K 1% 1/4W	19701	5043ED2K000F	1	341329000
R19-20	RES MF 80.6K 1% 1/4W	197D1	5043ED80K60F	2	341487000
R21-22	RES MF 4.99K 1% 1/4W	19701	5043ED4K990F	2	341367000
R23	RES MF 39.2K 1% 1/4W	19701	5043ED39K20F	1	341457000
R24	RES MF 1.82K 1% 1/4W	19701	5043ED1K820F	1	341325000
R25	RES MF 1.00K 1% 1/4W	19701	5D43ED1K000F	1	341300000
R26	RES MF 3.32K 1% 1/4W	19701	5D43ED3K320F	1	341350000
R27	RES MF 4.99K 1% 1/4W	197D1	5043ED4K990F	1	341367000
R28	RES MF 1.00K 1% 1/4W	19701	5043ED1K000F	1	341300000
R29-31	RES MF 49.9K 1% 1/4W	19701	5043ED49K90F	3	341467000
R32	RES MF 100K 1% 1/4W	19701	5D43ED100K0F	1	341500000
R33	RES MF 10.0K 1% 1/4W	19701	5043ED10K00F	1	341400000
R34-35	RES MF 49.9K 1% 1/4W	19701	5043ED49K90F	2	341467000
R36	RES MF 4.02K 1% 1/4W	19701	5043ED4K020F	1	341358000
R37-39	RES MF 10.0K 1% 1/4W	19701	5043ED10K00F	3	341400000
R40	RES MF 6.19K 1% 1/4W	19701	5043ED6K190F	1	341376000
R41	RES MF 9.95K 0.1% 1/8W	03888	PME55 T0	1	32591700A
R42	RES MF 20.0K 0.1% 1/8W	03888	PME55 T0	1	32591800A
R43	RES MF 40.0K 0.1% 1/8W	03888	PME55 T0	1	32591900A
R44	RES MF 80.0K 0.1% 1/8W	03888	PME55 T0	1	32592000A
R45	RES MF 160.0K 0.1% 1/8W	03888	PME55 TD	1	32592100A
R46	RES MF 320.0K 0.1% 1/8W	03888	PME55 T0	1	32592200A
R47	RES MF 649K 1% 1/4W	19701	5043ED649K0F	1	34157800A
R48	RES MF 1.21M 1% 1/4W	91637	CMF55-1214	1	341608000
R49	RES MF 9.95K 0.1% 1/8W	03888	PME55 T0	1	32591700A
R50	RES MF 20.0K 0.1% 1/8W	03888	PME55 T0	1	32591800A
R51	RES MF 40.0K 0.1% 1/8W	03888	PME55 T0	1	32591900A
R52	RES MF 80.0K 0.1% 1/8W	03888	PME55 T0	1	32592000A
R53	RES MF 160.0K 0.1% 1/8W	03888	PME55 TD	1	32592100A
R54	RES MF 320.0K 0.1% 1/8W	03888	PME55 T0	1	32592200A
R55	RES MF 649K 1% 1/4W	19701	5043ED649K0F	1	34157800A
R56	RES MF 1.21M 1% 1/4W	91637	CMF55-1214	1	341608000
R57	RES MF 1.82K 1% 1/4W	19701	5043ED1K820F	1	341325000
R58	RES MF 3.32K 1% 1/4W	19701	5043ED3K320F	1	341350000
R59-60	RES NETWORK 100K 2% 1.5W	71450	750-61-R100K	2	345032000
R61-63	RES NETWDRK 3.3K 2% 0.9W	71450	750-61-R3.3K	3	34504500A
R64	RES MF 619K 1% 1/4W	19701	RN55D-6193-F	1	341576000
R65	RES MF 1.00M 1% 1/4W	14674	5043E01M000F	1	341600000
R66	RES MF 10.0 ONM 1% 1/4W	19701	5043ED10R00F	1	341100000
U1	IC HA3-2625-5-M DP AMP	34371	MA3-2625-5	1	53511900A
U2	IC TL072CP DUAL OP AMP	01295	TL072CP	1	535092000
U3	IC OP-07EP OP AMP	06665	DP-07EP	1	535110000
U4	IC HA3-2625-5-M OP AMP	34371	MA3-2625-5	1	53511900A

11202100A
MODEL: 1120

REV: F0   PWA SOURCE 1120

REFERENCE DESIGNATOR	DESCRIPTION	FED. CODE	MANUFACTURER PART NUMBER	QTY	SEC PART NUMBER
U5	IC 74123 MONO MULTI	01295	SN74123N	1	534071000
U6	IC 74LS02 2 INPT POS NOR	01295	SN74LS02N	1	534154000
U7-8	IC 4200ADE ANALOG MULTIPLIER	49956	RC4200ADE	2	535083D1A
U9	IC HA1-5320-5 SAMPLE AND HOLD	34371	HA1-5320-5	1	53513000A
U10	IC SNP-11GY SAMPLE & HOLD AMPL	06665	SNP11GY	1	53444601A
U11-12	IC 5532A DUAL OP AMP 8 DIP	01295	NE5532AP	2	53512100A
U13-14	IC 339 QUAD COMPARATOR	27014	LM339N	2	535018000
U15-16	IC 74LS273 OCTAL D FLIPFLOP	01295	SN74LS273N	2	534263000
U17	IC 339 QUAD COMPARATOR	27014	LM339N	1	535018000
U18	IC 78L05 VOLT REG	07263	uA78L05AWC	1	535044000
U19	IC REF-02-C2 5 VOLT REFERENCE	06665	PMI REF-12CZ	1	53512900A
XU1-4	SOCKET IC 8 PIN	06776	ICN-083-S3-G	4	473041000
XU5	SOCKET IC 16 PIN	06776	ICN-163-S3-C	1	473042000
XU6	SOCKET IC 14 PIN	06776	ICN-143-S3-C	1	473019000
XU7-8	SOCKET IC 8 PIN	06776	ICN-083-S3-G	2	473041000
XU9-10	SOCKET IC 14 PIN	06776	ICN-143-S3-G	2	473019000
XU11-12	SOCKET IC 8 PIN	06776	ICN-083-S3-G	2	473041000
XU13-14	SOCKET IC 14 PIN	06776	ICN-143-S3-G	2	473019000
XU15-16	SOCKET IC 20 PIN	06776	ICN-203-S3-G	2	473065000
XU17	SOCKET IC 14 PIN	06776	ICN-143-S3-G	1	473019000
XU19	SOCKET IC 8 PIN	06776	ICN-083-S3-G	1	473041000

11202200B
MODEL: 1120

REV: GE   PWA OUTPUT 1120

REFERENCE DESIGNATOR	DESCRIPTION	FED. CODE	MANUFACTURER PART NUMBER	QTY	SEC PART NUMBER
C1-2	CAP MICA 100pF 5% 300V	20307	DM5-FC101J	2	205006000
C3-4	CAP MICA 12pF 5% 300V	57582	K05120J301	2	205005000
C5-6	CAP MICA 15pF 5% 300V	14655	CD5CC150J	2	205035000
C7	CAP MICA 22pF 5% 300V	14655	CD5CC220J	1	205036000
C8-9	CAP CER 1.0uF 20% 50V	04222	SR305E105MAA	2	224264000
C10-12	CAP CER 0.1uF 20% 50V	04222	SR215E104MAA	3	224268000
C13	CAP EL 100uF 20% 25V	54217	SM-25-V8-100-M	1	283334000
C14-17	CAP CER 0.1uF 20% 50V	04222	SR215E104MAA	4	224268000
C18-19	CAP EL 100uF 20% 25V	54217	SM-25-V8-100-M	2	283334000
CR1-7	DIODE SIG 1N914	01295	1N914	7	530058000
F1-2	FUSE 0.125 AMP 125V MICRO	75915	273.125	2	54554209A
K1-3	RELAY FORM "A"	15636	RA3080-1051	3	471033000
L1-2	INDUCTOR 5.6uH 10%	24226	10/561	2	400408000
Q1-2	TRANS NPN 2N3904	04713	2N3904	2	528071000
Q3-17	TRANS FET 2N5653 MOTOROLA ONLY	04713	2N5653	15	52816000A
Q18	TRANS NPN 2N3904	04713	2N3904	1	528071000
R1	RES MF 10.0K 1% 1/4W	19701	5043ED10K00F	1	341400000
R2	RES MF 15.0K 1% 1/4W	19701	5043ED15K00F	1	341417000
R3	RES MF 4.99K 1% 1/4W	19701	5043ED4K990F	1	341367000
R4-6	RES NETWORK 100K 2% 1.5W	71450	750-61-R100K	3	345032000
R7	RES MF 1.82K 1% 1/4W	19701	5043ED1K820F	1	341325000
R8	RES MF 3.01K 1% 1/4W	19701	5043ED3K010F	1	341346000
R9-10	RES MF 2.00K 1% 1/4W	19701	5043ED2K000F	2	341329000
R11-12	RES MF 1.00K 1% 1/4W	19701	5043ED1K000F	2	341300000
R13	RES MF 5.49K 1% 1/4W	19701	5043ED5K490F	1	341371000
R14	RES MF 33.2K 1% 1/4W	19701	5043ED33K20F	1	341450000
R15	RES VAR 50K 10% 0.5W	73138	82PAR50K	1	311375000
R16	RES MF 11.0K 1% 1/4W	19701	5043ED11K00F	1	341404000
R17	RES VAR 50K 10% 0.5W	73138	82PAR50K	1	311375000
R18	RES MF 95.3K 1% 1/4W	19701	5043ED95K30F	1	341494000
R19	RES MF 24.3K 1% 1/4W	19701	5043ED24K30F	1	341437000
R20	RES MF 90.9K 1% 1/4W	19701	5043ED90K90F	1	341492000
R21	RES VAR 50K 10% 0.5W	73138	82PAR50K	1	311375000
R22	RES MF 40.0K 0.1% 1/8W	03888	PME55 TO	1	32591900A
R23	RES MF 80.0K 0.1% 1/8W	03888	PME55 TO	1	32592000A
R24	RES MF 160.0K 0.1% 1/8W	03888	PME55 TO	1	32592100A
R25	RES MF 320.0K 0.1% 1/8W	03888	PME55 TO	1	32592200A
R26	RES MF 1.50K 1% 1/4W	19701	5043ED1K500F	1	341317000
R27	RES MF 100 OHM 1% 1/4W	19701	5043ED100R0F	1	341200000
R28	RES MF 40.0K 0.1% 1/8W	03888	PME55 TO	1	32591900A
R29	RES MF 80.0K 0.1% 1/8W	03888	PME55 TO	1	32592000A
R30	RES MF 160.0K 0.1% 1/8W	03888	PME55 TO	1	32592100A

11202200B REV: GE PWA OUTPUT 1120
MODEL: 1120

REFERENCE DESIGNATOR	DESCRIPTION	FED. CODE	MANUFACTURER PART NUMBER	QTY	BEC PART NUMBER
R31	RES MF 320.0K 0.1% 1/8W	03888	PME55 TO	1	32592200A
R32	RES MF 649K 1% 1/4W	19701	5043E0649K0F	1	34157800A
R33-34	RES MF 9K 0.1% 1/4W	64537	PME55-T2	2	324354000
R35-36	RES MF 2K 0.1% 1/8W	64537	PME55 T-0	2	324275000
R37	RES MF 1.5K 0.1% 1/8W	03888	PME55 TO	1	32592900A
R38-39	RES MF 2K 0.1% 1/8W	64537	PME55 T-0	2	324275000
R40	RES MF 1.5K 0.1% 1/8W	03888	PME55 TO	1	32592900A
R41	RES MF 300.0 OHM 0.1% 1/4W	03888	PME60 TO	1	32595400A
R42-43	RES MF 2.4K 0.1% 1/8W	03888	PME55 TO	2	32592800A
R44	RES MF 300.0 OHM 0.1% 1/4W	03888	PME60 TO	1	32595400A
R45-46	RES MF 2.4K 0.1% 1/8W	03888	PME55 TO	2	32592800A
R47-48	RES MF 60.0 OHM 0.1% 1/4W	03888	PME60 TO	2	32595100A
R49	RES MF 490.9 OHM 0.1% 1/4W	03888	PME60 TO	1	32595500A
R51	RES MF 490.9 OHM 0.1% 1/4W	03888	PME60 TO	1	32595500A
R52	RES MF 121.2 OHM 0.1% 1/4W	03888	PME60 TO	1	32595200A
R55-56	RES MF 182K 1% 1/4W	19701	5043ED182K0F	2	341525000
R57	RES MF 6.19K 1% 1/4W	19701	5043E06K190F	1	341376000
R58	RES MF 1.00K 1% 1/4W	19701	5043E01K000F	1	341300000
R59	RES MF 10.0 OHM 1% 1/4W	19701	5043E010R00F	1	341100000
R60-70	RES MF 10.0K 1% 1/4W	19701	5043E010K00F	11	341400000
U1	IC AD7548 12 BIT DAC CMOS	51640	AD7548	1	53512000A
U2	IC TL072ACP OPER AMPLIFIER	01295	TL072ACP	1	53507400A
U3	IC REF-01CP VOLTAGE REFERENCE	06665	REF-01CP	1	535116000
U4-5	IC 74LS273 OCTAL D FLIPFLOP	01295	SN74LS273N	2	534263000
U6-9	IC 339 QUAD COMPARATOR	27014	LM339N	4	535018000
U10-12	IC 5534AN OP AMP	18324	NE553AN	3	535061000
U13	IC 78L05 VOLT REG	07263	uA78L05AWC	1	535044000
XF1-2	FUSEHOLDER PWB HORIZ MOUNT	75915	281.007	2	48211802A
XU1	SOCKET IC 20 PIN	06776	ICN-203-S3-G	1	473065000
XU2-3	SOCKET IC 8 PIN	06776	ICN-083-S3-G	2	473041000
XU4-5	SOCKET IC 20 PIN	06776	ICN-203-S3-G	2	473065000
XU6-9	SOCKET IC 14 PIN	06776	ICN-143-S3-G	4	473019000
XU10-12	SOCKET IC 8 PIN	06776	ICN-083-S3-G	3	473041000

11201500A REV: 0* PWA MOTHER 1120
MODEL: 1120

REFERENCE DESIGNATOR	DESCRIPTION	FED. CODE	MANUFACTURER PART NUMBER	QTY	BEC PART NUMBER
C1	CAP CER 0.1uF 20% 50V	04222	SR215E104MAA	1	224268000
C2	CAP CER 1.0uF 20% 50V	04222	SR305E105MAA	1	224264000
J23-24	HEADER 5 PIN STRAIGHT	06383	MPSS156-5-C	2	477345000
J25	HEADER 3 PIN STRAIGHT .156 SPA	06383	MPSS156-3-C	1	477343000
J26-30	CONNECTOR "SMB"	19505	209	5	477317000
U1	IC 74LS138 DECDR/MPX	01295	SN74LS138N	1	534246000
U2	IC 74LS541 OCTAL BUFFER	01295	SN74LS541N	1	534381000
U3	IC 78L05 VOLT REG	07263	uA78L05AWC	1	535044000
U4	IC 74LS138 DECDR/MPX	01295	SN74LS138N	1	534246000
U5	IC 74LS541 OCTAL BUFFER	01295	SN74LS541N	1	534381000
XA0-7	CONNECTOR 36 PIN	31781	306-036-521-102	8	479338000
XU1	SOCKET IC 16 PIN	06776	ICN-163-S3-G	1	473042000
XU2	SOCKET IC 20 PIN	06776	ICN-203-S3-G	1	473065000
XU4	SOCKET IC 16 PIN	06776	ICN-163-S3-G	1	473042000
XU5	SOCKET IC 20 PIN	06776	ICN-203-S3-G	1	473065000

11201400B REV: BB PWA POWER SUPPLY 1120
MODEL: 1120

REFERENCE DESIGNATOR	DESCRIPTION	FED. CODE	MANUFACTURER PART NUMBER	QTY	BEC PART NUMBER
C1-2	CAP CER 0.1uF 20% 25V	51406	DD312E10Y5P104M25V	2	224364000
C4	CAP CER 0.1uF 20% 25V	51406	DD312E10Y5P104M25V	1	224364000
C5-7	CAP TANT 10uF 20% 25V	56289	196D106X0025KA1	3	283293000
C8	CAP CER 0.1uF 20% 50V	04222	SR215E104MAA	1	224268000
C9	CAP TANT 10uF 20% 25V	56289	196D106X0025KA1	1	283293000
C10-12	CAP CER 0.1uF 20% 50V	04222	SR215E104MAA	3	224268000
C13	CAP CER 0.001uF 10% 100V	04222	SR151C102KAA	1	224270000
C14	CAP CER 0.01uF 10% 100V	04222	SR201C103KAA	1	224269000
C15	CAP EL 100uF -10%+75% 25V	56289	TE-1211	1	283105000
C16-17	CAP EL 4500uF 20% 35V	56289	622D452M035AA2A	2	283339000
C18	CAP EL 26000uF 20% 16V	56289	622D263M016AC2A	1	283340000
CR3-4	DIODE ZENER 1N5242B 12V 5%	04713	1N5242B	2	530146000
CR5-6	DIODE SIG 1N4001	04713	1N4001	2	530151000
CR7	DIODE BRIDGE FWLO-50	11961	FWLA-50	1	532028000
CR8-11	DIODE SIG 1N4001	04713	1N4001	4	530151000
J14	HEADER 5 PIN STRAIGHT	06383	MPSS156-5-D	1	477345000
J15	HEADER 3 PIN STRAIGHT .156 SPA	06383	HPSS156-3-C	1	477343000
J16	HEADER 5 PIN STRAIGHT	06383	MPSS156-5-D	1	477345000
J17	HEADER 2 PIN STRAIGHT	06383	HPSS156-2-C	1	477342000
J18	HEADER 3 PIN STRAIGHT .156 SPA	06383	HPSS156-3-C	1	477343000
R1	RES MF 100K 1% 1/4W	19701	5043ED100K0F	1	341500000
R2-3	RES MF 1.00K 1% 1/4W	19701	5043ED1K000F	2	341300000
R4	RES MF 200K 1% 1/4W	19701	5043ED200K0F	1	341529000
R5	RES MF 10.0K 1% 1/4W	19701	5043ED10K00F	1	341400000
R6	RES MF 3.01K 1% 1/4W	19701	5043ED3K010F	1	341346000
R7	RES MF 1.00K 1% 1/4W	19701	5043ED1K000F	1	341300000
R8	RES MF 301 OHM 1% 1/4W	19701	5043ED301R0F	1	341246000
R9	RES VAR 1K 10% 0.5W	73138	72PR1K	1	311316000
R10	RES NETWORK 10K 0.1% 1.5W	73138	698-3R10KD	1	345010000
U1	IC 339 QUAD COMPARATOR	27014	LM339N	1	535018000
U2	IC TL072CP DUAL OP AMP	01295	TL072CP	1	535092000
U3	IC REF-01CP VOLTAGE REFERENCE	06665	REF-01CP	1	535116000
U4	IC 78L05 VOLT REG	07263	uA78L05AWC	1	535044000
W36	CABLE ASSY 2 COND 2 SPADE LUG	04901	571206000	1	571206000
W41	CABLE ASSEMBLY	04901	571204000	1	571204000
W42	CABLE ASSEMBLY	04901	571203000	1	571203000
XR10	SOCKET IC 16 PIN	06776	ICN-163-S3-C	1	473042000
XU1	SOCKET IC 14 PIN	06776	ICN-143-S3-G	1	473019000
XU2-3	SOCKET IC 8 PIN	06776	ICN-083-S3-C	2	473041000

11200900A REV: BA PWA DISPLAY 1120
MODEL: 1120

REFERENCE DESIGNATOR	DESCRIPTION	FED. CODE	MANUFACTURER PART NUMBER	QTY	BEC PART NUMBER
C1-11	CAP CER 0.1uF 20% 50V	04222	SR215E104MAA	11	224268000
C12	CAP EL 100uF 20% 25V	84217	SM-25-VB-100-M	1	283334000
C13-16	CAP CER 0.1uF 20% 50V	04222	SR215E104MAA	4	224268000
C17	CAP EL 100uF 20% 25V	84217	SM-25-VB-100-M	1	283334000
DS1-6	DISPLAY NUMERIC 5082-7651	28480	5082-7651	6	536811000
DS7-8	LED LIGHT BAR MOD NLMP-2620	28480	NLMP-2620	2	536027000
DS9-16	DISPLAY NUMERIC 5082-7651	28480	5082-7651	8	536811000
DS17-19	LED LIGHT BAR MOD NLMP-2620	28480	HLMP-2620	3	536027000
DS20-21	DISPLAY NUMERIC 5082-7651	28480	5082-7651	2	536811000
DS22	LED LIGHT BAR MOD NLMP-2620	28480	NLMP-2620	1	536027000
J31	CONNECTOR HEADER 2 PIN RT ANLE	06383	HPAS156-2-C	1	477385000
J32	CONN M 26 CKT RT ANGLE 3 WALL	06776	IDH-26K-SR3-TC30	1	47741326A
P33A-33B	CONNECTOR HEADER 17 PIN	27264	22-03-2171	1	47741117A
P34	CONNECTOR 20 PIN STRAIGHT	27264	22-03-2201	1	477397000
R1	RES NETWORK 22 OHM +-2 OHM 2W	01121	316B-220	1	345034000
R2-3	RES NETWORK 3K/6.2K 2% 2.7W	73138	785-5-R3K/6.2K	2	345031000
R4-6	RES NETWORK 150 OHM 2% 1.5W	73138	898-3-R150	3	345026000
R7-10	RES NETWORK 330 OHM 2% 1.5W	73138	898-3-R330	4	345027000
U1	IC ULN2803A TRANSISTOR ARRAY	56289	ULN2803A	1	534274000
U2-3	IC UDN2585A	56289	UDN2585A	2	534392000
U4	IC 8279-2 KEYBD/DISP INTERFACE	33297	uPD8279C-2	1	534211000
U5-7	IC 74LS138 DECOR/MPX	01295	SN74LS138N	3	534246000
U8-10	IC 74LS273 OCTAL D FLIPFLOP	01295	SN74LS273N	3	534263000

11200900A REV: BA PWA OISPLAY 1120
MOOEL: 1120

REFERENCE OESIGNATOR	DESCRIPTION	FEO. COOE	MANUFACTURER PART NUMBER	QTY	BEC PART NUMBER
U12	IC 74L6273 OCTAL O FLIPFLOP	01295	SN74LS273N	1	534263000
U14	IC 74L8273 OCTAL O FLIPFLOP	01295	6N74L8273N	1	534263000
U16	IC 74LS273 OCTAL O FLIPFLOP	01295	SN74L6273N	1	534263000
U17-19	IC 74LS138 OECOR/MPX	01295	SN74LS138N	3	534246000
U20	IC 74L600 2 INP P06 NAND	01295	SN74LSOON	1	534167000
XOS1-6	SOCKET IC 14 PIN	06776	ICN-143-W8-C	6	473066000
XO67-8	SOCKET IC 16 PIN	06776	ICN-163-W8-TC	2	473047000
XO69-16	SOCKET IC 14 PIN	06776	ICN-143-W8-C	8	473066000
XO617-19	SOCKET IC 16 PIN	06776	ICN-163-W8-TC	3	473047000
XOS20-21	SOCKET IC 14 PIN	06776	ICN-143-W8-C	2	473066000
XOS22	6OCKET IC 16 PIN	06776	ICN-163-W8-TC	1	473047000
XR1	SOCKET IC 16 PIN	06776	ICN-163-S3-C	1	473042000
XR4-10	6OCKET IC 16 PIN	06776	ICN-163-S3-G	7	473042000
XU1-3	6OCKET IC 18 PIN	06776	ICN-183-S3-TC	3	473045000
XU4	8OCKET IC 40 PIN LOW PROFILE	06776	ICT-406-S-TG	1	473068000
XU5-7	SOCKET IC 16 PIN	06776	ICN-163-S3-G	3	473042000
XU8-10	SOCKET IC 20 PIN	06776	ICN-203-S3-C	3	473065000
XU12	SOCKET IC 20 PIN	06776	ICN-203-S3-C	1	473065000
XU14	SOCKET IC 20 PIN	06776	ICN-203-S3-G	1	473065000
XU16	6OCKET IC 20 PIN	06776	ICN-203-S3-G	1	473065000
XU17-19	SOCKET IC 16 PIN	06776	ICN-163-S3-C	3	473042000
XU20	SOCKET IC 14 PIN	06776	ICN-143-S3-C	1	473019000

11201000A REV: C* PWA KEYBOARO 1120
MOOEL: 1120

REFERENCE OESIGNATOR	DESCRIPTION	FEO. COOE	MANUFACTURER PART NUMBER	QTY	BEC PART NUMBER
C1-2	CAP CER 0.1uF 20% 50V	04222	8R215E104NAA	2	224268000
C3-4	CAP TANT 15uF 10% 20V	56289	196O156X9020KA1	2	283227000
C5	CAP TANT 4.7uF 10% 10V	56289	196O475X9010NA1	1	283226000
C6	CAP CER 0.01uF 10% 100V	04222	8R201C103KAA	1	224269000
J1-2	WIRE,BARE,6OLIO 24 AWC	04901	920148240	2	920148240
J33A-338	CONNECTOR 17 PIN (F)	27264	22-02-2175	1	47945617A
J34	CONNECTOR 20 PIN	27264	22-02-2205	1	479399000
R1-2	RES NF 2.00K 1% 1/4W	19701	5043E02K000F	2	341329000
R3-4	RES NF 100K 1% 1/4W	19701	5043E0100K0F	2	341500000
R5-6	RES NF 49.9K 1% 1/4W	19701	5043E049K90F	2	341467000
S1	SWITCN PUSN BUTTON W/O LEO	31918	200330	1	465294000
S2-4	6WITCN PU6N BUTTON W/LEO	31918	200480	3	465293000
S5-9	SWITCN PUSN BUTTON W/O LEO	31918	200330	5	465294000
S10-12	SWITCN PUSN BUTTON W/LEO	31918	200480	3	465293000
S13-17	SWITCN PUSN BUTTON W/O LEO	31918	200330	5	465294000
S18-19	8WITCN PUSN BUTTON W/LEO	31918	200480	2	465293000
S20-24	6WITCN PU6N BUTTON W/O LEO	31918	200330	5	465294000
S25-26	6WITCN PU6N BUTTON W/LEO	31918	200480	2	465293000
S27-31	SWITCN PUSN BUTTON W/O LEO	31918	200330	5	465294000
S32-33	SWITCN PUSN BUTTON W/LEO	31918	200480	2	465293000
S34-38	SWITCN PUSN BUTTON W/O LEO	31918	200330	5	465294000
S39-52	SWITCN PU6N BUTTON W/LEO	31918	200480	14	465293000
U1	IC 74123 MONO MULTI	01295	8N74123N	1	534071000
U2	IC 7555 TIMER CMO8 8 OIP	32293	ICM7555IPA	1	53512600A
U3	IC 74LS02 2 INPT POS NOR	01295	8N74L602N	1	534134000
U4	IC 4066A CMO8 8ILAT 6W	02735	CO4066AE	1	534078000

97401801A REV: A- OPT -11 1120 400Hz HP FILTER
MODEL: 1120/1130

REFERENCE DESIGNATOR	DESCRIPTION	FED. CODE	MANUFACTURER PART NUMBER	QTY	BEC PART NUMBER
A1A30	PWA 400Hz HIGH PASS FILTER			1	11203800A

11203800A REV: 8A PWA 400Hz HIGH PASS FILTER
MODEL: 1120-11

REFERENCE DESIGNATOR	DESCRIPTION	FED. CODE	MANUFACTURER PART NUMBER	QTY	BEC PART NUMBER
C1	CAP MPC 0.022uF 2% 50V	14752	652A-1-A223G	1	234166000
C2-3	CAP CER 0.1uF 20% 50V	04222	SR215E104MAA	2	224268000
C4	CAP MPC 0.022uF 2% 50V	14752	652A-1-A223G	1	234166000
C5-6	CAP EL 10uF 20% 25V	54217	SM-25-VB-10-M	2	283336000
C7	CAP MICA 20pF 5% 300V	14655	CD5CC200J	1	205017000
C8-10	CAP MPC 0.022uF 2% 50V	14752	652A-1-A223G	3	234166000
C11	CAP MICA 20pF 5% 300V	14655	CD5CC200J	1	205017000
C12-13	CAP MPC 0.033uF 2% 50V	27735	MPC-53-0.033-50-2	2	23417600A
J1-10	TERMINAL .040 OD .270 LG .062M	98291	229-1071-230	10	510038000
R1	RES MF 4.75K 1% 1/4W	19701	5043ED4K750F	1	341365000
R2	RES MF 45.3K 1% 1/4W	19701	5043ED45K30F	1	341463000
R3	RES MF 6.19K 1% 1/4W	19701	5043ED6K190F	1	341376000
R4	RES MF 4.32K 1% 1/4W	19701	5043ED4K320F	1	341361000
R5	RES MF 28.7K 1% 1/4W	19701	5043ED28K70F	1	341444000
R6	RES MF 1.10K 1% 1/4W	19701	5043ED1K100F	1	341304000
R7	RES MF 121K 1% 1/4W	19701	5043ED121K0F	1	341508000
U1-2	IC 5534AN OP AMP	18324	NE553AN	2	535061000
XU1-2	SOCKET IC 8 PIN	06776	ICN-083-S3-G	2	473041000

97401901A REV: A- DPT -12 1120 CCITT BAND P FILT
MODEL: 1120/1130

REFERENCE DESIGNATOR	DESCRIPTION	FED. CODE	MANUFACTURER PART NUMBER	QTY	BEC PART NUMBER
A1A31	PWA CCITT FILTER			1	11204000A

11204000A REV: AA PWA CCITT FILTER
MODEL: 1120-12

REFERENCE DESIGNATOR	DESCRIPTION	FED. CODE	MANUFACTURER PART NUMBER	QTY	BEC PART NUMBER
C1	CAP MPC 0.01uF 2% 50V	14752	652A-1A-103G	1	234142000
C2	CAP MICA 1000pF 5% 100V	14655	CD15FA102J	1	200505000
C3-4	CAP CER 0.1uF 20% 50V	04222	BR215E104MAA	2	224268000
C5-6	CAP EL 10uF 20% 25V	54217	SM-25-VB-10-M	2	283336000
C7	CAP MPC 0.01uF 2% 50V	14752	652A-1A-103G	1	234142000
C8	CAP MPC 0.0047uF 2% 50V	14752	652A-1-A472G	1	23417300A
C9	CAP MPC 0.1uF 2% 50V	14752	652A-1-A-104G	1	234139000
C10	CAP MICA 560pF 1% 300V	14655	CD15FC561F	1	200091000
C11	CAP MPC 0.047uF 2% 50V	14752	652A-1-A473C	1	234144000
C12	CAP MPC 0.022uF 2% 50V	14752	652A-1-A223G	1	234166000
C13	CAP MPC 0.047uF 2% 50V	14752	652A-1-A473C	1	234144000
C14-16	CAP MPC 0.1uF 2% 50V	14752	652A-1-A-104G	3	234139000
J1-10	TERMINAL .040 DO .270 LG .062M	98291	229-1071-230	10	510038000
R1	RES MF 23.2K 1% 1/4W	19701	5043ED23K20F	1	34143500A
R2	RES MF 15.0K 1% 1/4W	19701	5043ED15K00F	1	341417000
R3	RES MF 1.15K 1% 1/4W	19701	5043ED1K150F	1	341306000
R4	RES MF 2.15K 1% 1/4W	19701	5043ED2K150F	1	341332000
R5	RES MF 26.1K 1% 1/4W	19701	5043ED26K10F	1	341440000
R6	RES MF 9.09K 1% 1/4W	19701	5043ED9K090F	1	341392000
R7	RES MF 6.04K 1% 1/4W	19701	5043ED6K040F	1	341375000
R8	RES MF 5.62K 1% 1/4W	19701	5043ED5K620F	1	341372000
R9	RES MF 6.04K 1% 1/4W	19701	5043ED6K040F	1	341375000
R10	RES MF 4.53K 1% 1/4W	19701	5043ED4K530F	1	341363000
R11	RES MF 100 OHM 1% 1/4W	19701	5043ED100R0F	1	341200000
R12	RES MF 26.1K 1% 1/4W	19701	5043ED26K10F	1	341440000
R13	RES MF 14.3K 1% 1/4W	19701	5043ED14K30F	1	341415000
R14	RES MF 1.10K 1% 1/4W	19701	5043ED1K100F	1	341304000
R15	RES MF 5.76K 1% 1/4W	19701	5043ED5K760F	1	341373000
U1-2	IC 5532A DUAL OP AMP 8 DIP	01295	NE5532AP	2	53512100A
XU1-2	SOCKET IC 8 PIN	06776	ICN-083-S3-G	2	473041000

97402001A REV: A- OPT -13 1120 CCIR FILTER
MODEL: 1120/1130

REFERENCE DESIGNATOR	DESCRIPTION	FED. CODE	MANUFACTURER PART NUMBER	QTY	BEC PART NUMBER
A1A32	PWA CCIR WEIGHTING FILTER			1	11203700A

11203700A REV: 8A PWA CCIR WEIGHTING FILTER
MODEL: 1120-17

REFERENCE DESIGNATOR	DESCRIPTION	FED. CODE	MANUFACTURER PART NUMBER	QTY	BEC PART NUMBER
C1	CAP MICA 1500pF 1% 100V	57582	KSDM15-1500G100F	1	20013100A
C2	CAP MPC 0.0047uF 1% 50V	14752	652A-1A-472F	1	23418100A
C3	CAP MICA 1500pF 1% 100V	57582	KSDM15-1500G100F	1	20013100A
C4-5	CAP MPC 0.0047uF 1% 50V	14752	652A-1A-472F	2	23418100A
C6-8	CAP MICA 1500pF 1% 100V	57582	KSDM15-1500G100F	3	20013100A
C9-10	CAP CER 0.1uF 20% 50V	04222	SR215E104MAA	2	224268000
C11-12	CAP EL 10uF 20% 25V	54217	SM-25-VB-10-M	2	283336000
J1-10	TERMINAL .040 OD .270 LG .062M	98291	229-1071-230	10	510038000
R1	RES MF 10.0K 1% 1/4W	19701	5043ED10K00F	1	341400000
R2	RES MF 5.62K 1% 1/4W	19701	5043ED5K620F	1	341372000
R3	RES MF 27.4K 1% 1/4W	19701	5043ED27K40F	1	341442000
R4-5	RES MF 5.62K 1% 1/4W	19701	5043ED5K620F	2	341372000
R6	RES MF 392 OHM 1% 1/4W	19701	5043ED392R0F	1	341257000
R7-9	RES MF 5.62K 1% 1/4W	19701	5043ED5K620F	3	341372000
R10	RES MF 20.0K 1% 1/4W	19701	5043ED20K00F	1	341429000
R11	RES VAR 2K 10% 0.5W	73138	72XWR2K	1	311347000
U1-2	IC 5532A DUAL OP AMP 8 DIP	01295	NE5532AP	2	53512100A
XU1-2	SOCKET IC 8 PIN	06776	ICN-083-S3-G	2	473041000

97402201A REV: A- DPT -15 1120 "A" WEIGHT FILTER
MODEL: 1120/1130

REFERENCE DESIGNATOR	DESCRIPTION	FED. CODE	MANUFACTURER PART NUMBER	QTY	BEC PART NUMBER
A1A34	PWA A,B,C WEIGHTING FILTERS			1	11203900A

11203900A REV: AA PWA A,B,C WEIGHTING FILTERS
MODEL: 1120-15-16

REFERENCE DESIGNATOR	DESCRIPTION	FED. CODE	MANUFACTURER PART NUMBER	QTY	BEC PART NUMBER
C1-2	CAP MICA 500pF 1% 500V	14655	CD15FD501F	2	200123000
C3	CAP MICA 20pF 5% 300V	14655	CD5CC200J	1	205017000
C4	CAP MPC 0.047uF 2% 50V	14752	652A-1-A473G	1	234144000
C5	CAP MICA 20pF 5% 300V	14655	CD5CC200J	1	205017000
C6-8	CAP MPC 0.047uF 2% 50V	14752	652A-1-A473G	3	234144000
C9-10	CAP EL 10uF 20% 25V	S4217	SM-25-VB-10-M	2	283336000
C11-12	CAP CER 0.1uF 20% 50V	04222	SR215E104MAA	2	224268000
JC/8)	HEADER 3 PIN STRAIGHT	06383	MFSS100-3-C-A	1	477364000
J1-10	TERMINAL .040 OD .270 LG .062M	98291	229-1071-230	10	510038000
J11(A	HEADER 3 PIN STRAIGHT	06383	MFSS100-3-C-A	1	477364000
J12(ABC)	HEADER 4 PIN STRAIGHT	06383	MFSS100-A-A	1	47742004A
P11-12	SHUNT 2 CIRCUIT	27264	15-38-1024	2	483253000
R1-2	RES MF 25.5K 1% 1/4W	19701	5043ED25K50F	2	341439000
R3	RES MF 16.9K 1% 1/4W	19701	5043ED16K90F	1	341422000
R4	RES MF 4.53K 1% 1/4W	19701	5043ED4K530F	1	341363000
R5	RES MF 40.2K 1% 1/4W	19701	5043ED40K20F	1	341458000
R6-7	RES MF 165K 1% 1/4W	19701	5043ED165K0F	2	341521000
U1-2	IC 5534AH OP AMP	18324	NE553AH	2	535061000
XU1-2	SOCKET IC 8 PIN	06776	ICN-083-S3-G	2	473041000

97402101A REV: A- DPT -14 1120 CCIR/ARM FILTER
MODEL: 1120/1130

REFERENCE DESIGNATOR	DESCRIPTION	FED. CODE	MANUFACTURER PART NUMBER	QTY	BEC PART NUMBER
A1A33	PWA CCIR WEIGHTING FILTER			1	11203700A

11203700A REV: BA PWA CCIR WEIGHTING FILTER
MODEL: 1120-17

REFERENCE DESIGNATOR	DESCRIPTION	FED. CODE	MANUFACTURER PART NUMBER	QTY	BEC PART NUMBER
C1	CAP MICA 1500pF 1% 100V	57582	KSDM15-1500G100F	1	20013100A
C2	CAP MPC 0.0047uF 1% 50V	14752	652A-1A-472F	1	23418100A
C3	CAP MICA 1500pF 1% 100V	57582	KSDM15-1500G100F	1	20013100A
C4-5	CAP MPC 0.0047uF 1% 50V	14752	652A-1A-472F	2	23418100A
C6-8	CAP MICA 1500pF 1% 100V	57582	KSDM15-1500G100F	3	20013100A
C9-10	CAP CER 0.1uF 20% 50V	04222	SR215E104MAA	2	224268000
C11-12	CAP EL 10uF 20% 25V	54217	SM-25-VB-10-M	2	283336000
J1-10	TERMINAL .040 OD .270 LG .062M	98291	229-1071-230	10	510038000
R1	RES MF 10.0K 1% 1/4W	19701	5043ED10K00F	1	341400000
R2	RES MF 5.62K 1% 1/4W	19701	5043ED5K620F	1	341372000
R3	RES MF 27.4K 1% 1/4W	19701	5043ED27K40F	1	341442000
R4-5	RES MF 5.62K 1% 1/4W	19701	5043ED5K620F	2	341372000
R6	RES MF 392 OHM 1% 1/4W	19701	5043ED392R0F	1	341257000
R7-9	RES MF 5.62K 1% 1/4W	19701	5043ED5K620F	3	341372000
R10	RES MF 20.0K 1% 1/4W	19701	5043ED20K00F	1	341429000
R11	RES VAR 2K 10% 0.5W	73138	72XWR2K	1	311347000
U1-2	IC 5532A DUAL OP AMP 8 DIP	01295	NE5532AP	2	53512100A
XU1-2	SOCKET IC 8 PIN	06776	ICN-083-S3-G	2	473041000

97402301A REV: A- DPT -16 1120 "B" WEIGHT FILTER
MODEL: 1120/1130

REFERENCE DESIGNATOR	DESCRIPTION	FED. CODE	MANUFACTURER PART NUMBER	QTY	BEC PART NUMBER
A1A35	PWA A,B,C WEIGHTING FILTERS			1	11203900A

11203900A REV: AA PWA A,B,C WEIGHTING FILTERS
MODEL: 1120-15-16

REFERENCE DESIGNATOR	DESCRIPTION	FED. CODE	MANUFACTURER PART NUMBER	QTY	BEC PART NUMBER
C1-2	CAP MICA 500pF 1% 500V	14655	CD15FD501F	2	200123000
C3	CAP MICA 20pF 5% 300V	14655	CD5CC200J	1	205017000
C4	CAP MPC 0.047uF 2% 50V	14752	652A-1-A473G	1	234144000
C5	CAP MICA 20pF 5% 300V	14655	CD5CC200J	1	205017000
C6-8	CAP MPC 0.047uF 2% 50V	14752	652A-1-A473G	3	234144000
C9-10	CAP EL 10uF 20% 25V	54217	SM-25-VS-10-M	2	283336000
C11-12	CAP CER 0.1uF 20% 50V	04222	SR215E104MAA	2	224268000
JC/B)	HEADER 3 PIN STRAIGHT	06383	MFSS100-3-C-A	1	477364000
J1-10	TERMINAL .040 OD .270 LG .062M	98291	229-1071-230	10	510038000
J11(A	HEADER 3 PIN STRAIGHT	06383	MFSS100-3-C-A	1	477364000
J12(ABC)	HEADER 4 PIN STRAIGHT	06383	MFSS100-A-A	1	47742004A
P11-12	SHUNT 2 CIRCUIT	27264	15-38-1024	2	483253000
R1-2	RES MF 25.5K 1% 1/4W	19701	5043ED25K50F	2	341439000
R3	RES MF 16.9K 1% 1/4W	19701	5043ED16K90F	1	341422000
R4	RES MF 4.53K 1% 1/4W	19701	5043ED4K530F	1	341363000
R5	RES MF 40.2K 1% 1/4W	19701	5043ED40K20F	1	341458000
R6-7	RES MF 165K 1% 1/4W	19701	5043ED165K0F	2	341521000
U1-2	IC 5534AN OP AMP	18324	NE553AN	2	535061000
XU1-2	SOCKET IC 8 PIN	06776	ICN-083-S3-G	2	473041000

97402401A REV: A- OPT -17 1120 "C" WEIGHT FILTER
MODEL: 1120/1130

REFERENCE DESIGNATOR	DESCRIPTION	FED. CODE	MANUFACTURER PART NUMBER	QTY	BEC PART NUMBER
A1A36	PWA A,B,C WEIGNTING FILTERS			1	11203900A

11203900A REV: AA PWA A,B,C WEIGHTING FILTERS
MODEL: 1120-15-16

REFERENCE DESIGNATOR	DESCRIPTION	FED. CODE	MANUFACTURER PART NUMBER	QTY	BEC PART NUMBER
C1-2	CAP MICA 500pF 1% 500V	14655	CD15FD501F	2	200123000
C3	CAP MICA 20pF 5% 300V	14655	CD5CC200J	1	205017000
C4	CAP MPC 0.047uF 2% 50V	14752	652A-1-A473G	1	234144000
C5	CAP MICA 20pF 5% 300V	14655	CD5CC200J	1	205017000
C6-8	CAP MPC 0.047uF 2% 50V	14752	652A-1-A473G	3	234144000
C9-10	CAP EL 10uF 20% 25V	S4217	SM-25-VB-10-M	2	283336000
C11-12	CAP CER 0.1uF 20% 50V	04222	SR215E104MAA	2	224268000
JC/B)	HEADER 3 PIN STRAIGHT	06383	MFSS100-3-C-A	1	477364000
J1-10	TERMINAL .040 OD .270 LG .062M	98291	229-1071-230	10	510038000
J11(A	HEADER 3 PIN STRAIGHT	06383	MFSS100-3-C-A	1	477364000
J12(ABC)	HEADER 4 PIN STRAIGNT	06383	MFSS100-A-A	1	47742004A
P11-12	SHUNT 2 CIRCUIT	27264	15-38-1024	2	483253000
R1-2	RES MF 25.5K 1% 1/4W	19701	5043ED25K50F	2	341439000
R3	RES MF 16.9K 1% 1/4W	19701	5043ED16K90F	1	341422000
R4	RES MF 4.53K 1% 1/4W	19701	5043ED4K530F	1	341363000
R5	RES MF 40.2K 1% 1/4W	19701	5043ED40K20F	1	341458000
R6-7	RES MF 165K 1% 1/4W	19701	5043ED165K0F	2	341521000
U1-2	IC 5534AH OP AMP	18324	NE553AH	2	535061000
XU1-2	SOCKET IC 8 PIN	06776	ICN-083-S3-G	2	473041000

97402501A REV: A- OPT -18 1120 AUDIO BAND P FILT
MODEL: 1120/1130

REFERENCE DESIGNATOR	DESCRIPTION	FED. CODE	MANUFACTURER PART NUMBER	QTY	BEC PART NUMBER
A1A37	PWA AUDIO BAND PASS FILTER			1	11203600A

11203600A REV: BA PWA AUDIO BAND PASS FILTER
MODEL: 1120-16

REFERENCE DESIGNATOR	DESCRIPTION	FED. CODE	MANUFACTURER PART NUMBER	QTY	BEC PART NUMBER
C1	CAP MICA 1000pF 1% 100V	51406	DM15-102F	1	200113000
C2	CAP MICA 220pF 1% 50V	14655	CD5FY221F	1	20505900A
C3	CAP MICA 20pF 5% 300V	14655	CD5CC200J	1	205017000
C4	CAP MPC 0.022uF 2% 50V	14752	652A-1-A223G	1	234166000
C5-6	CAP MPC 0.047uF 2% 50V	14752	652A-1-A473G	2	234144000
C7	CAP MICA 20pF 5% 300V	14655	CD5CC200J	1	205017000
C8	CAP MPC 0.047uF 2% 50V	14752	652A-1-A473G	1	234144000
C9-10	CAP EL 10uF 20% 25V	S4217	SN-25-V8-10-M	2	283336000
C11-12	CAP CER 0.1uF 20% 50V	04222	SR215E104NAA	2	224268000
J1-10	TERMINAL .040 OD .270 LG .062N	98291	229-1071-230	10	510038000
R1	RES MF 21.5K 1% 1/4W	19701	5043ED21K50F	1	341432000
R2	RES MF 10.5K 1% 1/4W	19701	5043ED10K50F	1	341402000
R3	RES MF 301 OHM 1% 1/4W	19701	5043ED301R0F	1	341246000
R4	RES MF 75.0K 1% 1/4W	19701	5043ED75K00F	1	341484000
R5	RES MF 301K 1% 1/4W	19701	5043ED301K0F	1	341546000
R6	RES MF 150K 1% 1/4W	19701	5043ED150K0F	1	341517000
U1-2	IC 5534AN OP AMP	18324	NE553AN	2	535061000
XU1-2	SOCKET IC 8 PIN	06776	ICN-083-S3-G	2	473041000

97402601A REV: A- OPT -19 C MSG FILTER 1120
MODEL: 1120-19

REFERENCE DESIGNATOR	DESCRIPTION	FED. CODE	MANUFACTURER PART NUMBER	QTY	BEC PART NUMBER
A1A38	PWA C MSG FILTER			1	11207000A

11207000A REV: AA PWA C MSG FILTER
MODEL: 1120-19

REFERENCE DESIGNATOR	DESCRIPTION	FED. CODE	MANUFACTURER PART NUMBER	QTY	BEC PART NUMBER
C1-4	CAP MPC 0.022uF 2% 50V	14752	632A-1-A223G	4	234166000
C5-8	CAP MPC 0.0022uF 2% 50V	14752	653A-1-A222G	4	234165000
C9-10	CAP CER 0.1uF 20% 50V	04222	SR215E104MAA	2	224268000
C11-12	CAP EL 10uF 20% 25V	S4217	SM-25-VB-10-M	2	283336000
J1-10	TERMINAL .040 OD .270 LG .062M	98291	229-1071-230	10	510038000
R1	RES MF 17.4K 1% 1/4W	19701	5043ED17K40F	1	341423000
R2	RES MF 30.1K 1% 1/4W	19701	5043ED30K10F	1	341446000
R3	RES MF 3.32K 1% 1/4W	19701	5043ED3K320F	1	341350000
R4	RES MF 19.1K 1% 1/4W	19701	5043ED19K10F	1	341427000
R5	RES MF 8.25K 1% 1/4W	19701	5043ED8K250F	1	341388000
R6	RES MF 95.3K 1% 1/4W	19701	5043ED95K30F	1	341494000
R7	RES MF 3.65K 1% 1/4W	19701	5043ED3K650F	1	341354000
R8	RES MF 110K 1% 1/4W	19701	5043ED110K0F	1	341504000
U1-2	IC 5532A DUAL OP AMP 8 DIP	01295	NE5532AP	2	53512100A
XU1-2	SOCKET IC 8 PIN	06776	ICN-083-S3-G	2	473041000

SECTION VII
SCHEMATIC DIAGRAMS

7-1. TABLE OF CONTENTS.

Figure **Page**

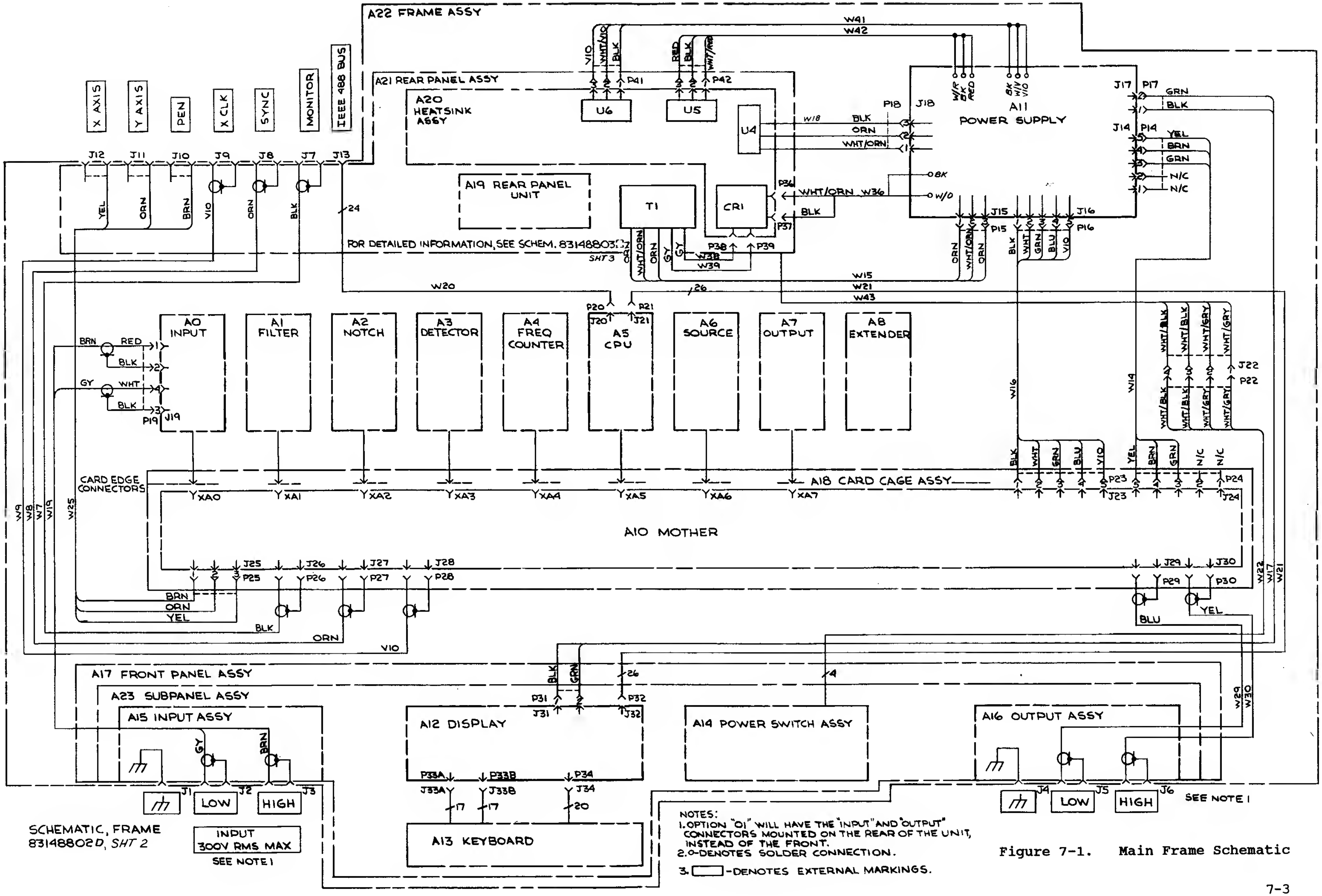


Figure 7-1. Main Frame Schematic

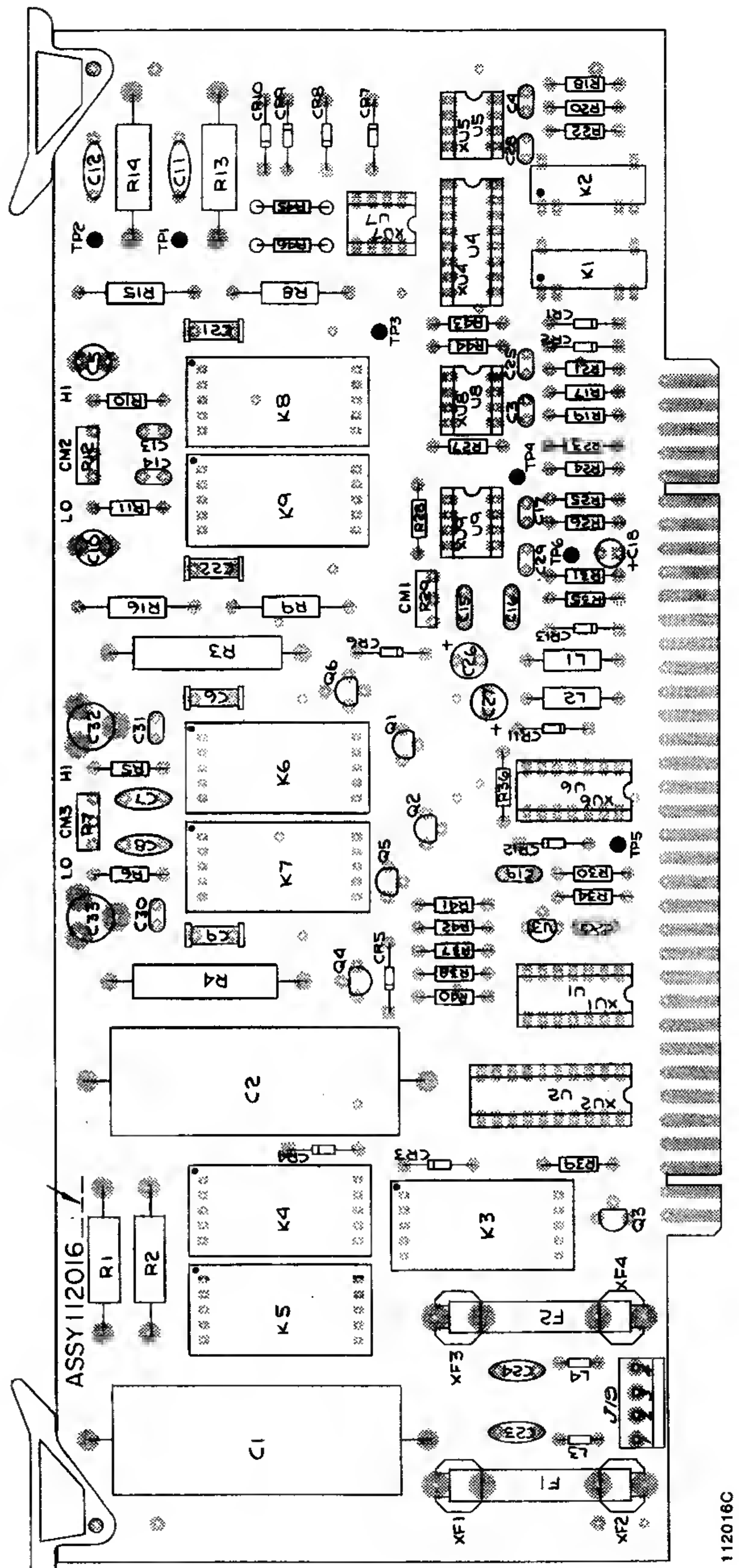
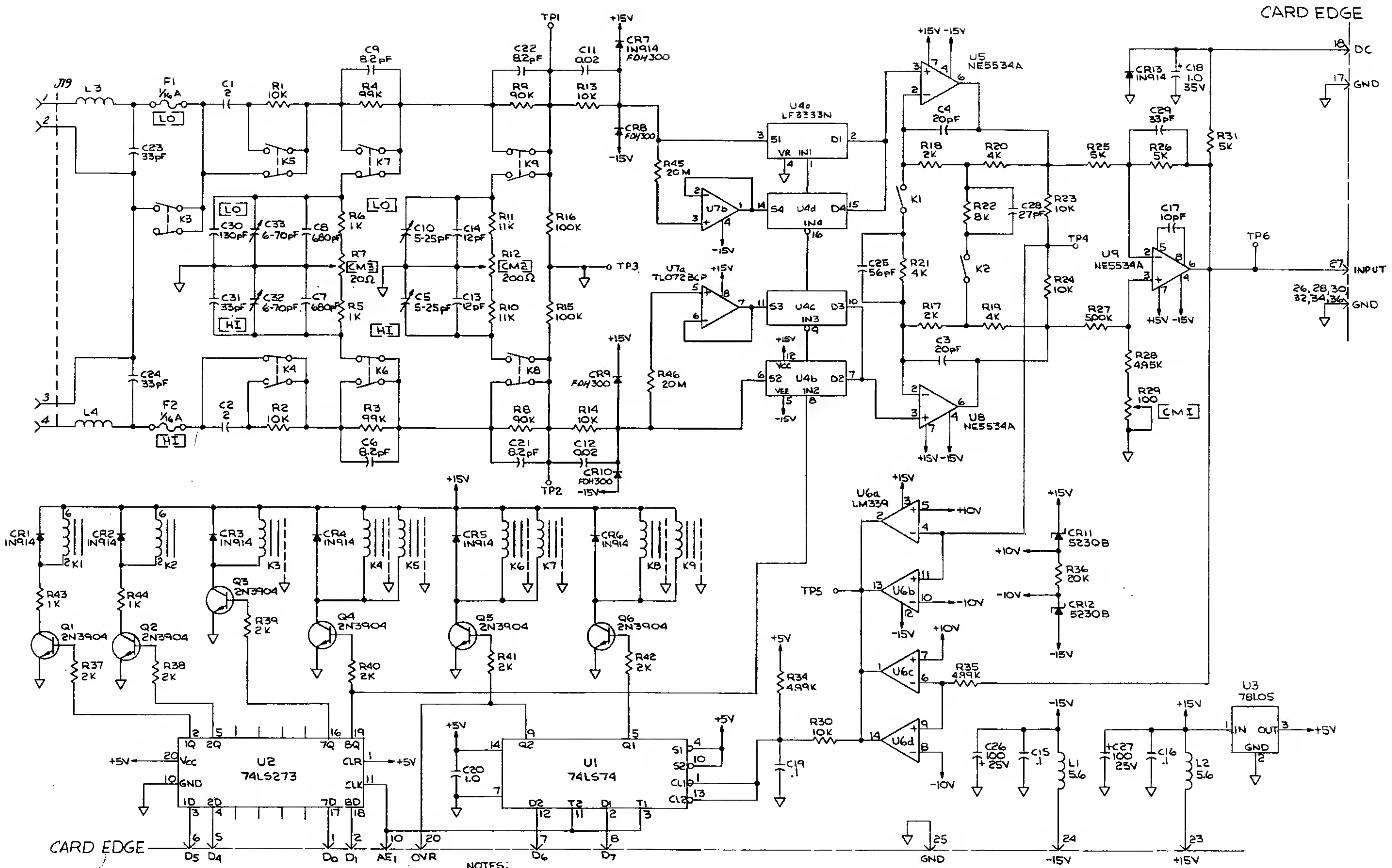


Figure 7-2. Input Board A0 Parts Location Diagram



CARD EDGE

SCHEMATIC, INPUT
831488808D

NOTES:
1. CAPACITANCE VALUES IN μF UNLESS OTHERWISE SPECIFIED.
2. RESISTANCE VALUES IN OHMS UNLESS OTHERWISE SPECIFIED.
3. LAST NUMBERS USED:
C33, R46, U9

Figure 7-3. Input Board A0 Schematic

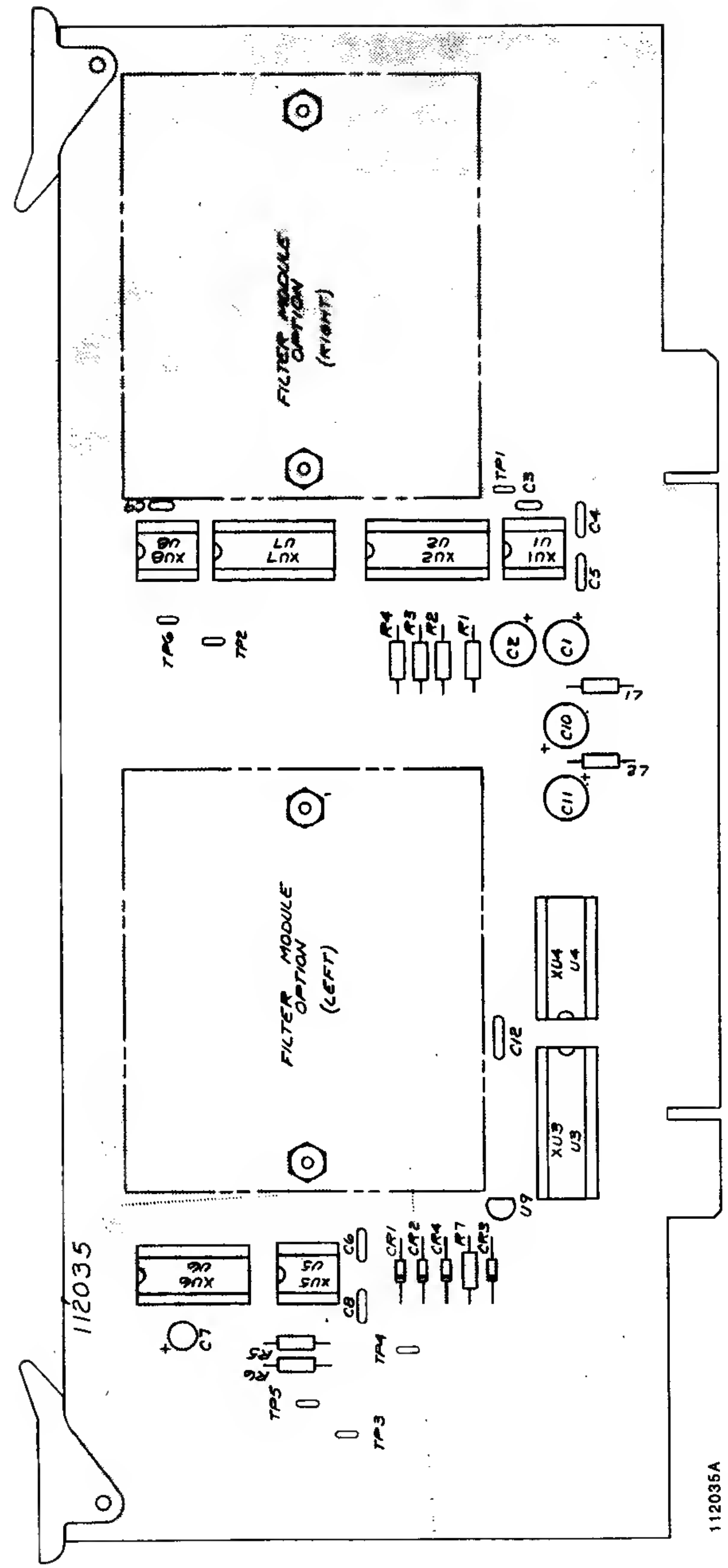


Figure 7-4. Filter Board A1 Parts Location Diagram

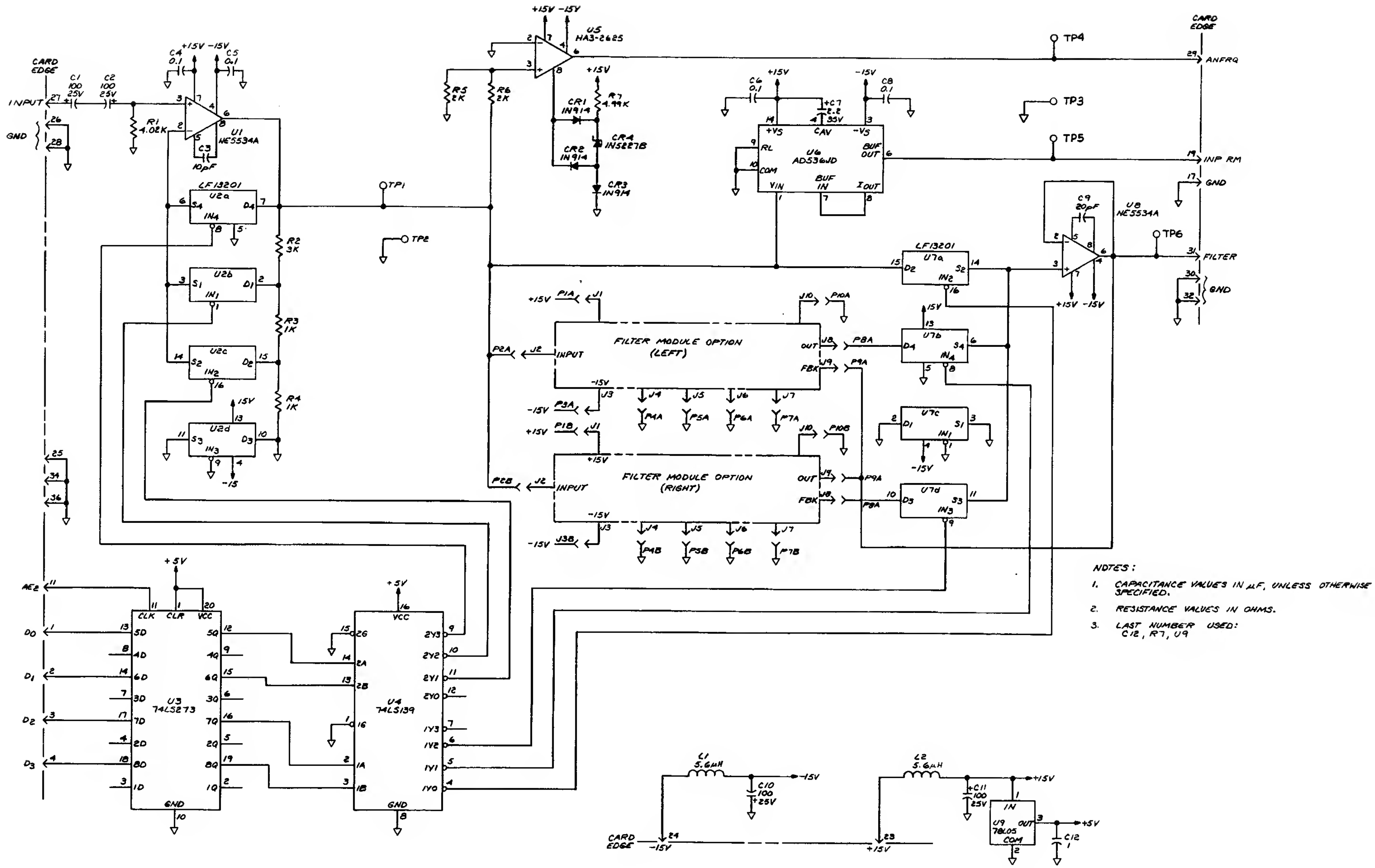


Figure 7-5. Filter Board A1 Schematic

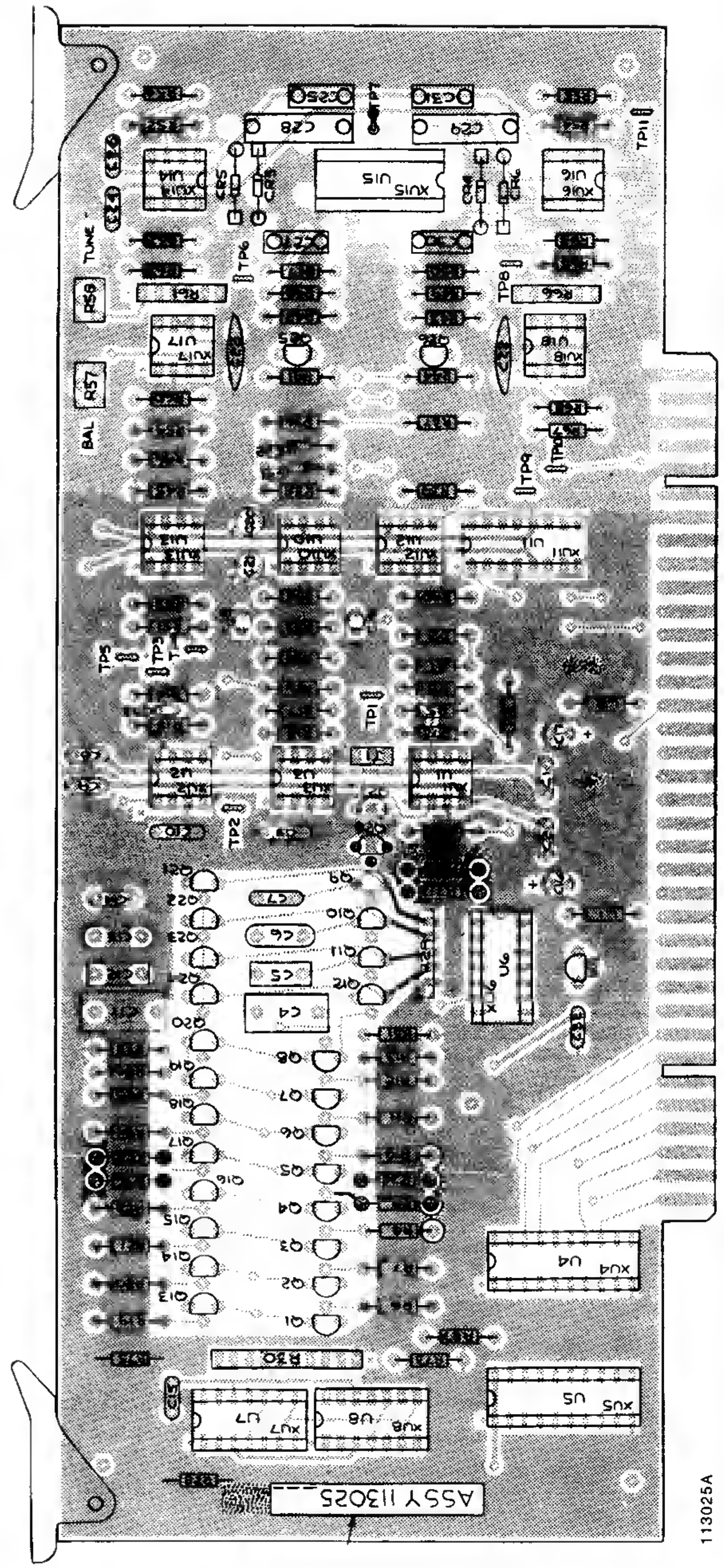
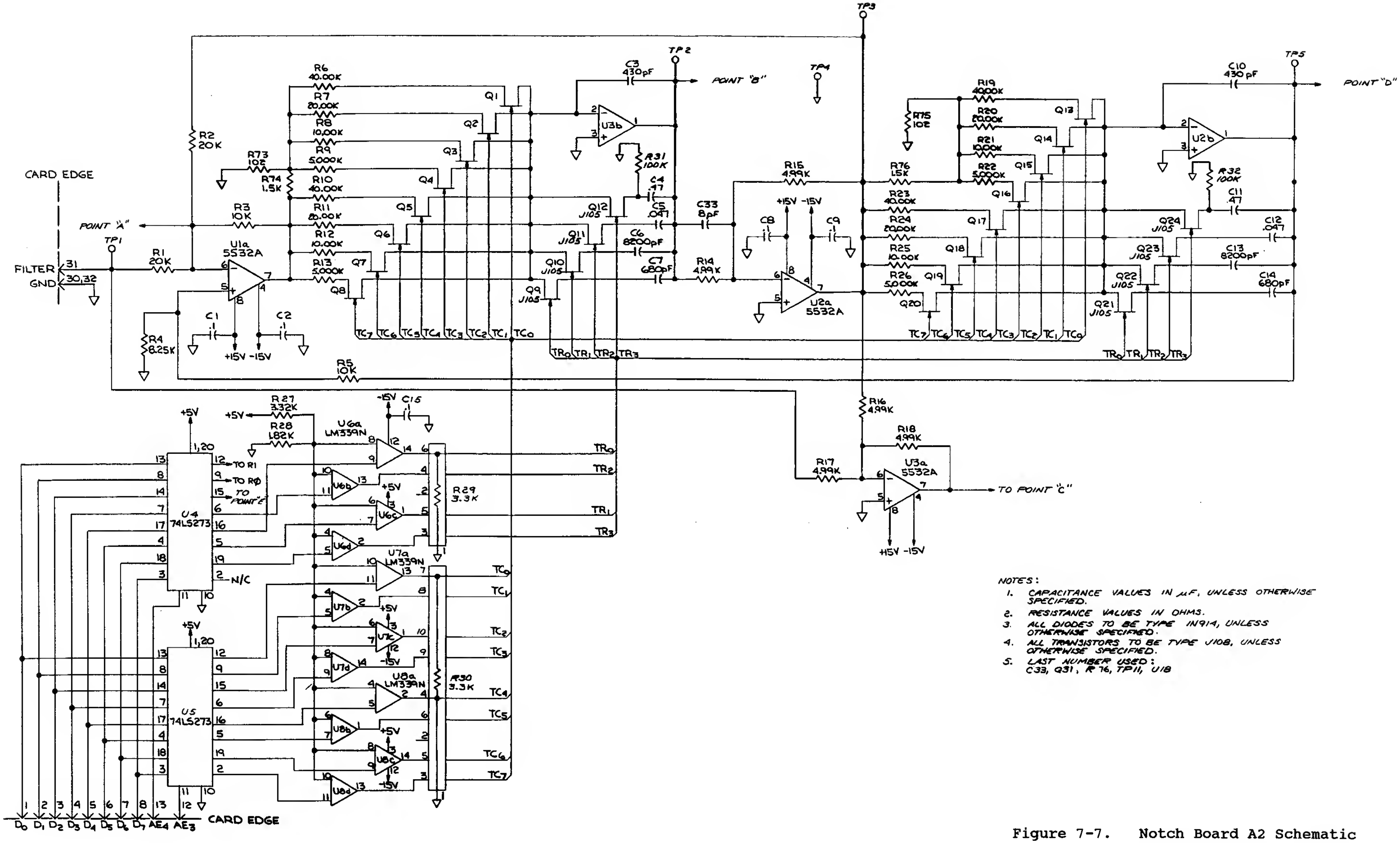


Figure 7-6.   Notch Board A2 Parts Location Diagram



NOTES:

1. CAPACITANCE VALUES IN μF, UNLESS OTHERWISE SPECIFIED.
2. RESISTANCE VALUES IN OHMS.
3. ALL DIODES TO BE TYPE IN914, UNLESS OTHERWISE SPECIFIED.
4. ALL TRANSISTORS TO BE TYPE J108, UNLESS OTHERWISE SPECIFIED.
5. LAST NUMBER USED: C33, Q31, R76, TP11, U18

Figure 7-7. Notch Board A2 Schematic (Sheet 1 of 2)

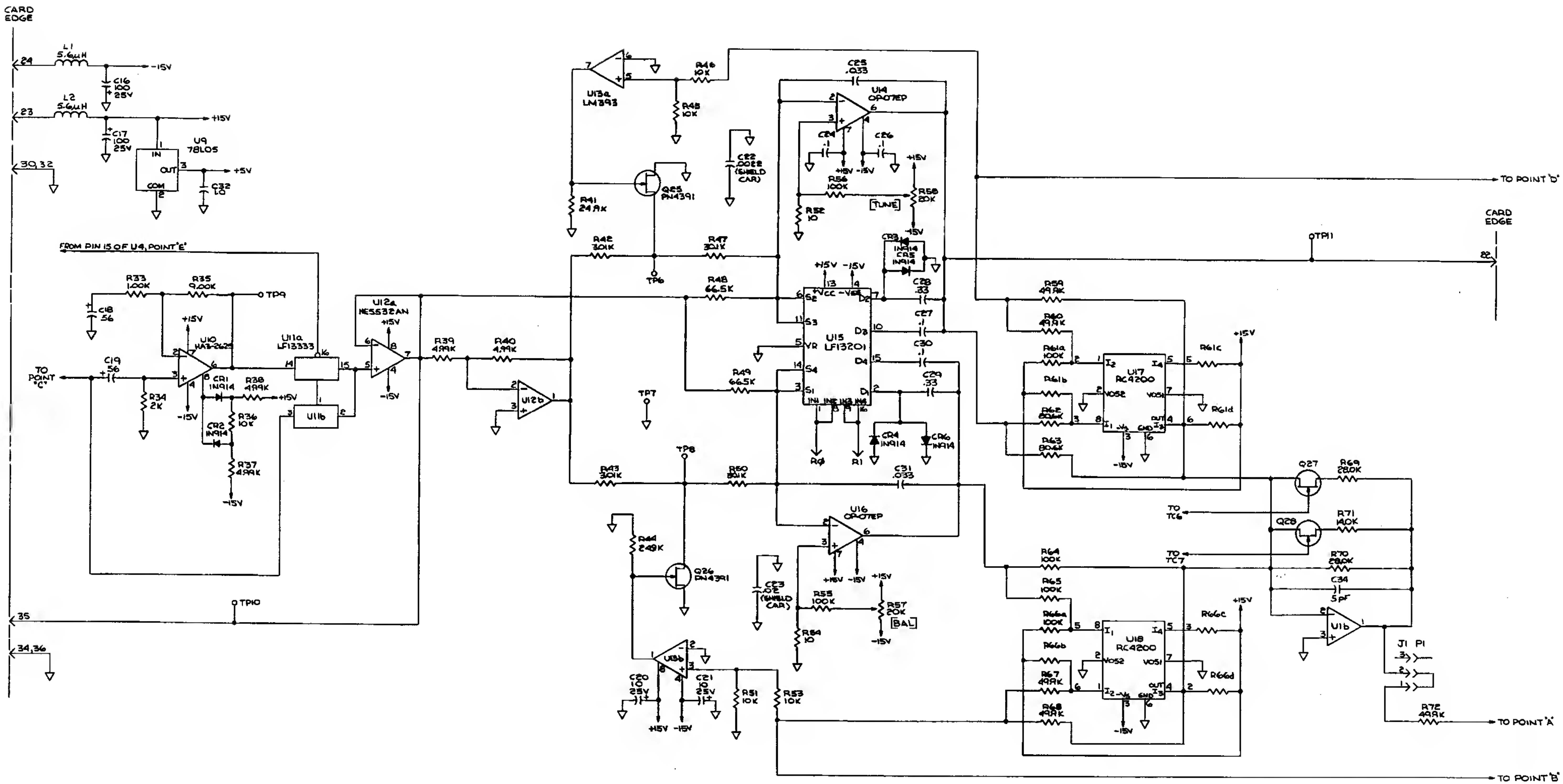


Figure 7-8. Notch Board A2 Schematic (Sheet 2 of 2)

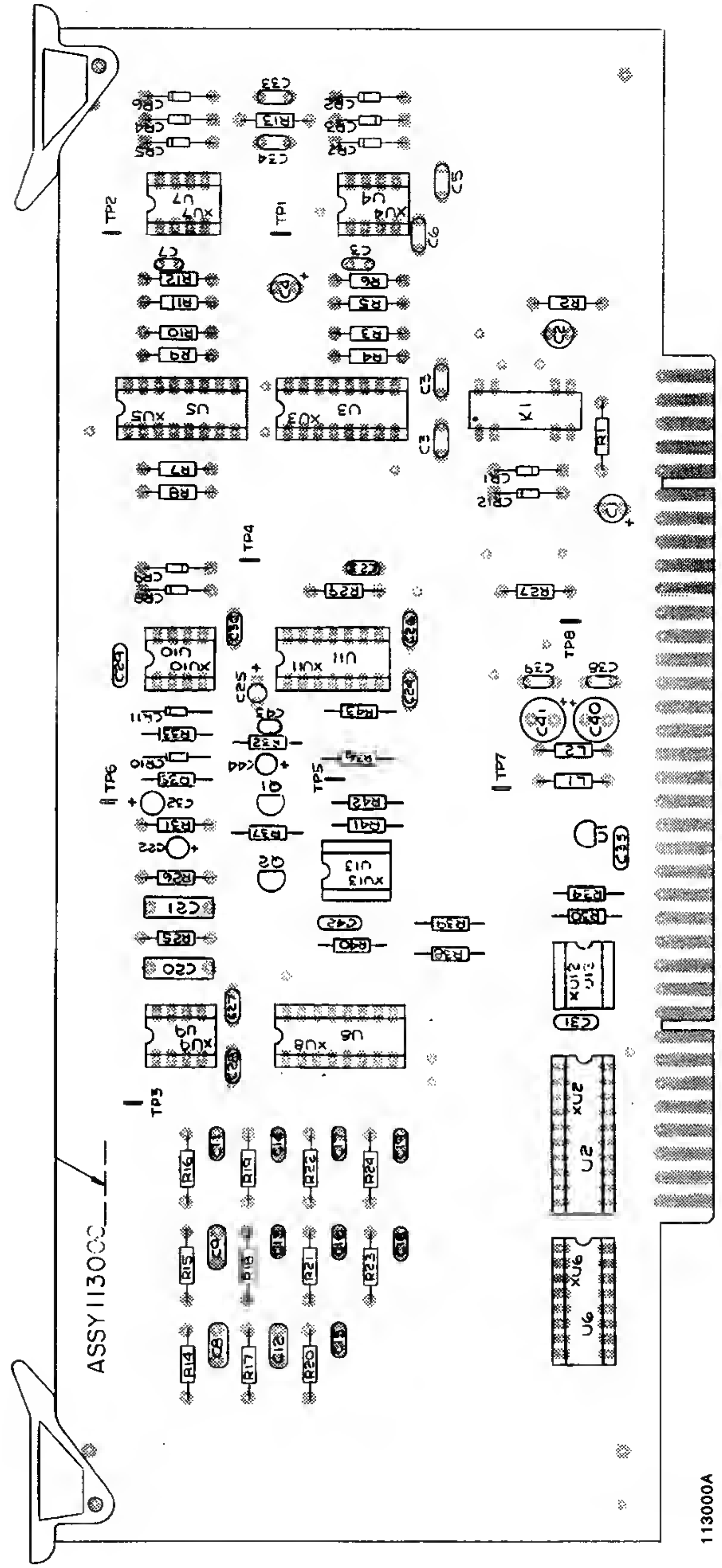
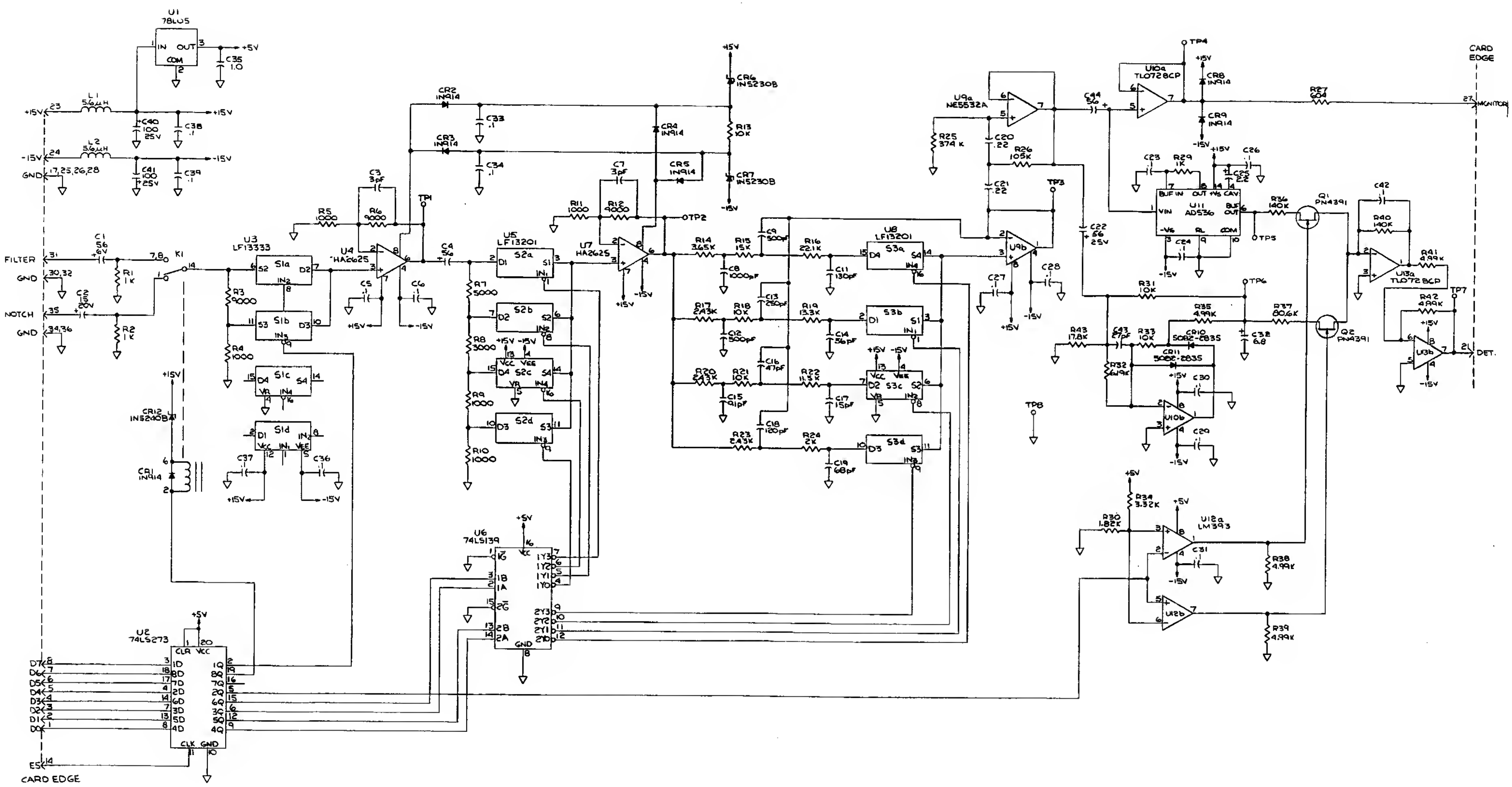


Figure 7-9. Detector Board A3 Parts Location Diagram



NOTES:
1. CAPACITANCE VALUES IN µF UNLESS OTHERWISE SPECIFIED.
2. RESISTANCE VALUES IN OHMS UNLESS OTHERWISE SPECIFIED.
3. LAST NUMBERS USED:
R43, U13, C44, CR12

Figure 7-10. Detector Board A3 Schematic

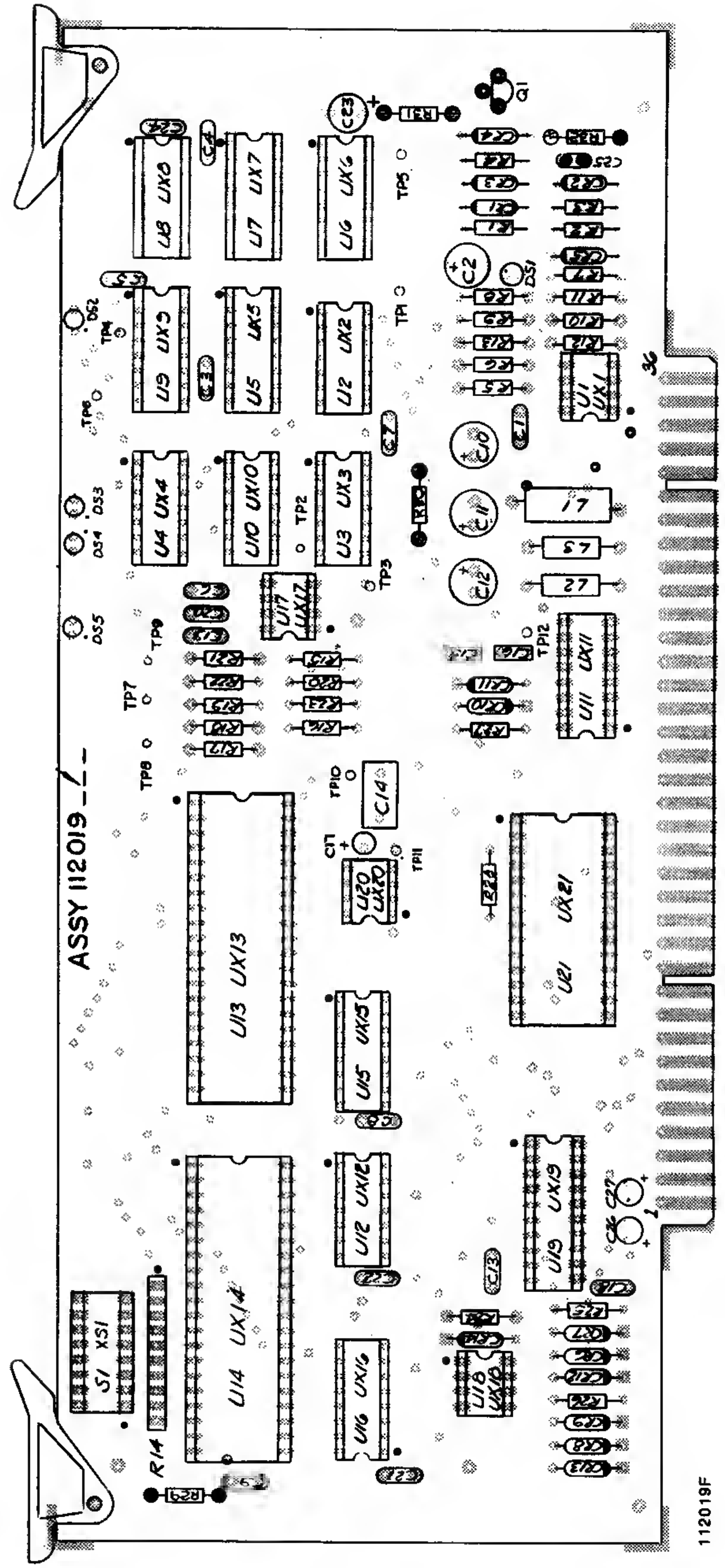
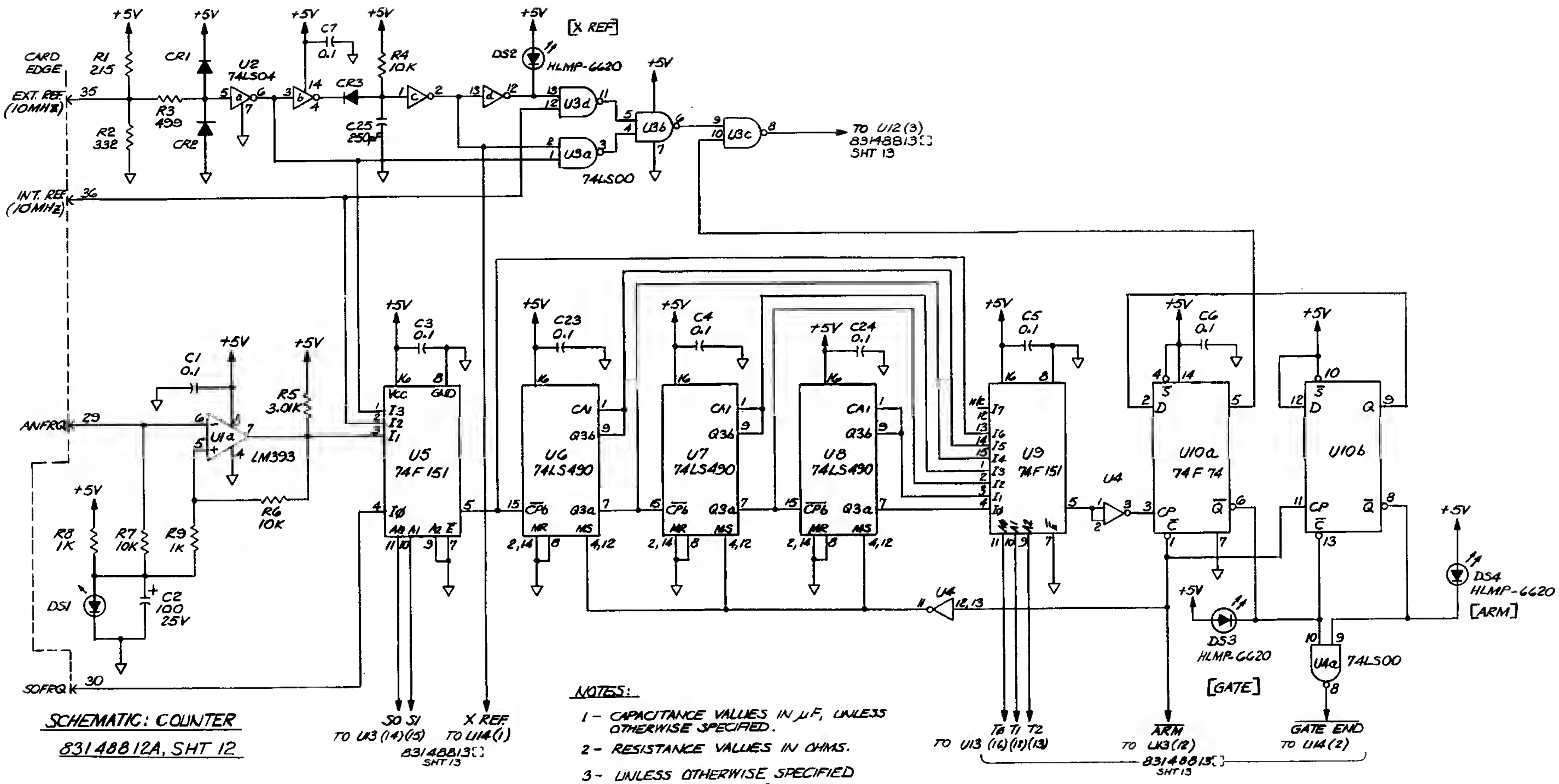


Figure 7-11. Counter Board A4 Parts Location Diagram

A4 SCHEMATIC, COUNTER



SCHEMATIC: COUNTER

83148812A, SHT 12

NOTES:

1 - CAPACITANCE VALUES IN µF, UNLESS OTHERWISE SPECIFIED.

2 - RESISTANCE VALUES IN OHMS.

3 - UNLESS OTHERWISE SPECIFIED DIODES ARE IN914.

4 - LAST NUMBERS USED: R28, C27, L3, U21, CR14, DS5

Figure 7-12. Counter Board A4 Schematic (Sheet 1 of 3)

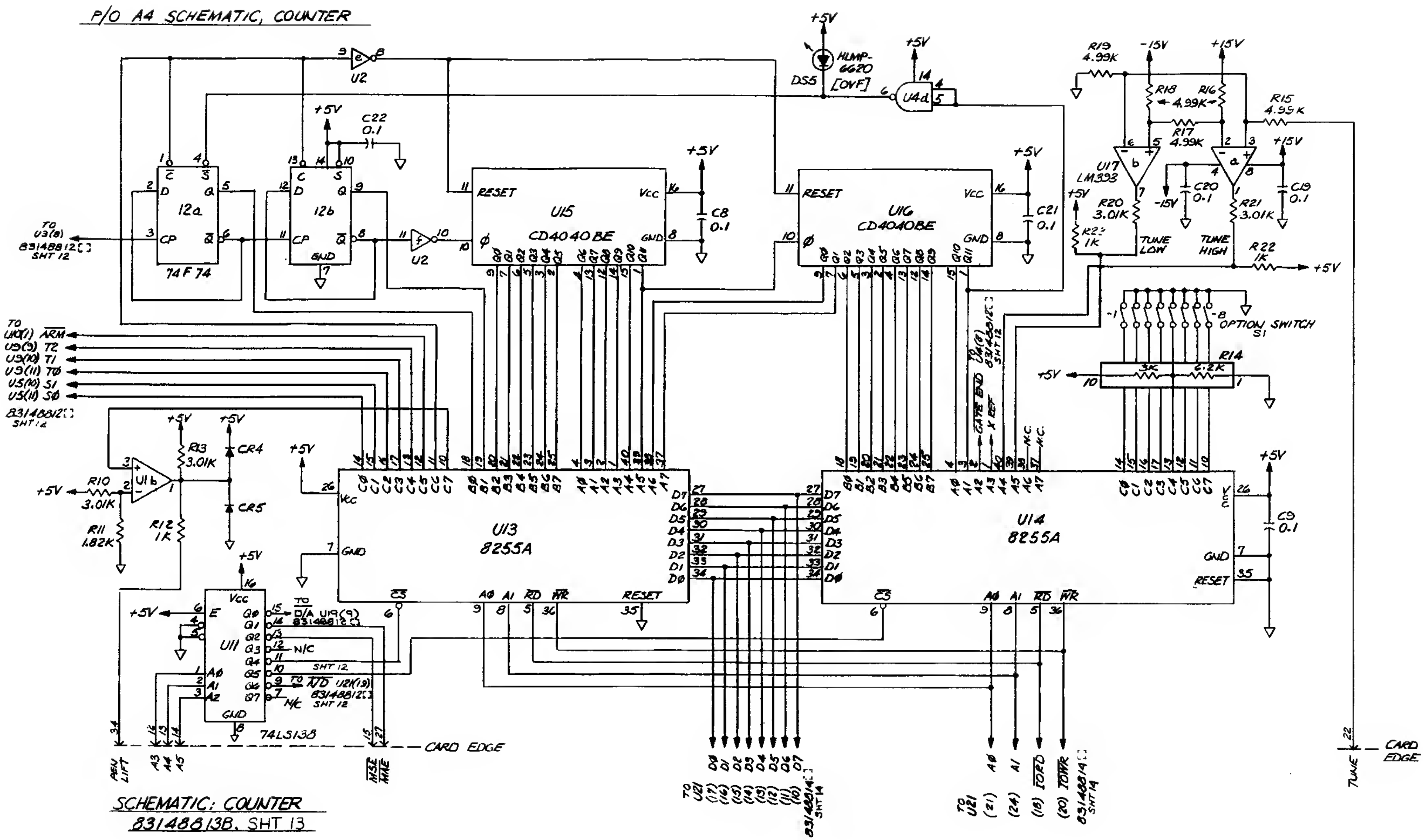


Figure 7-13. Counter Board A4 Schematic (Sheet 2 of 3)

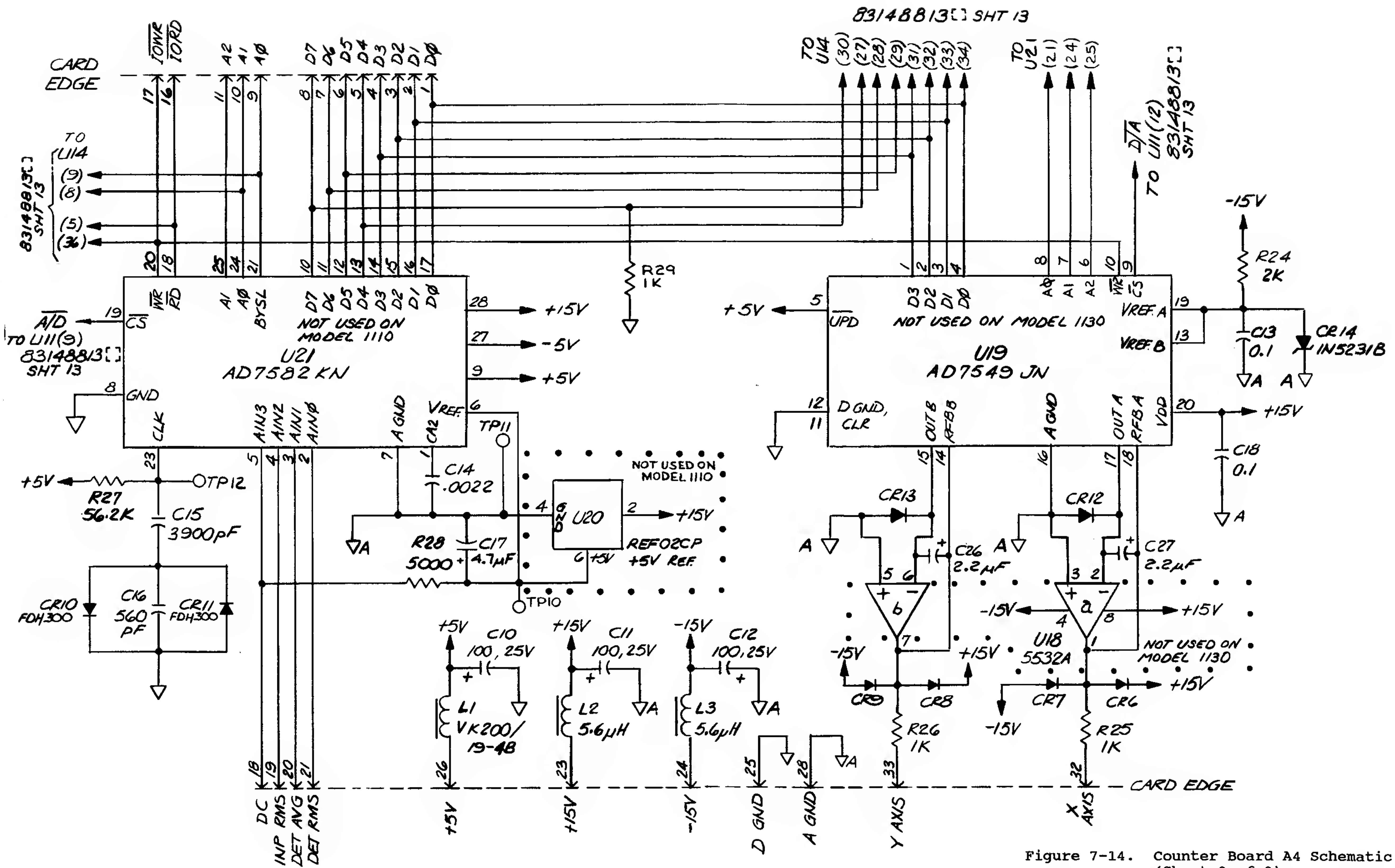


Figure 7-14. Counter Board A4 Schematic (Sheet 3 of 3)

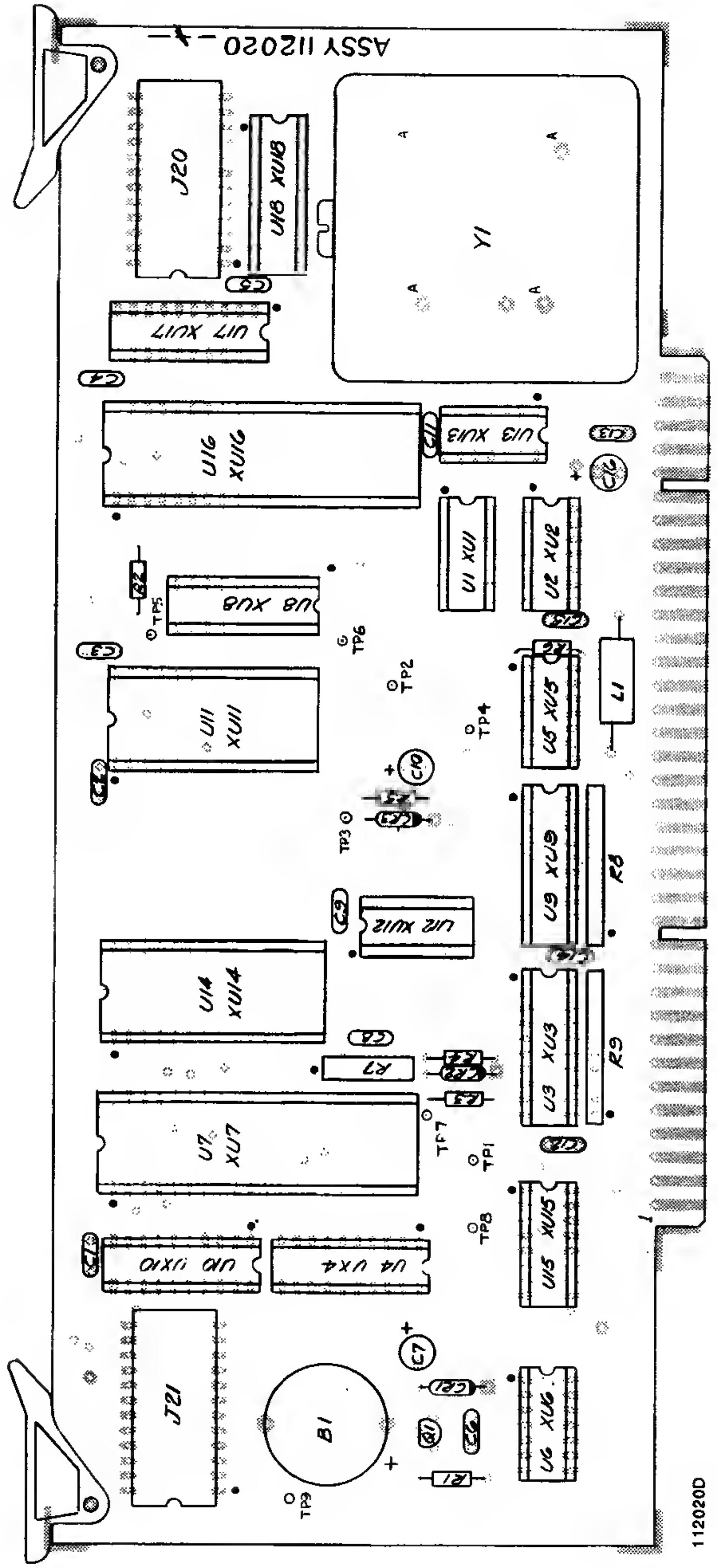


Figure 7-15. C.P.U Board A5 Parts Location Diagram

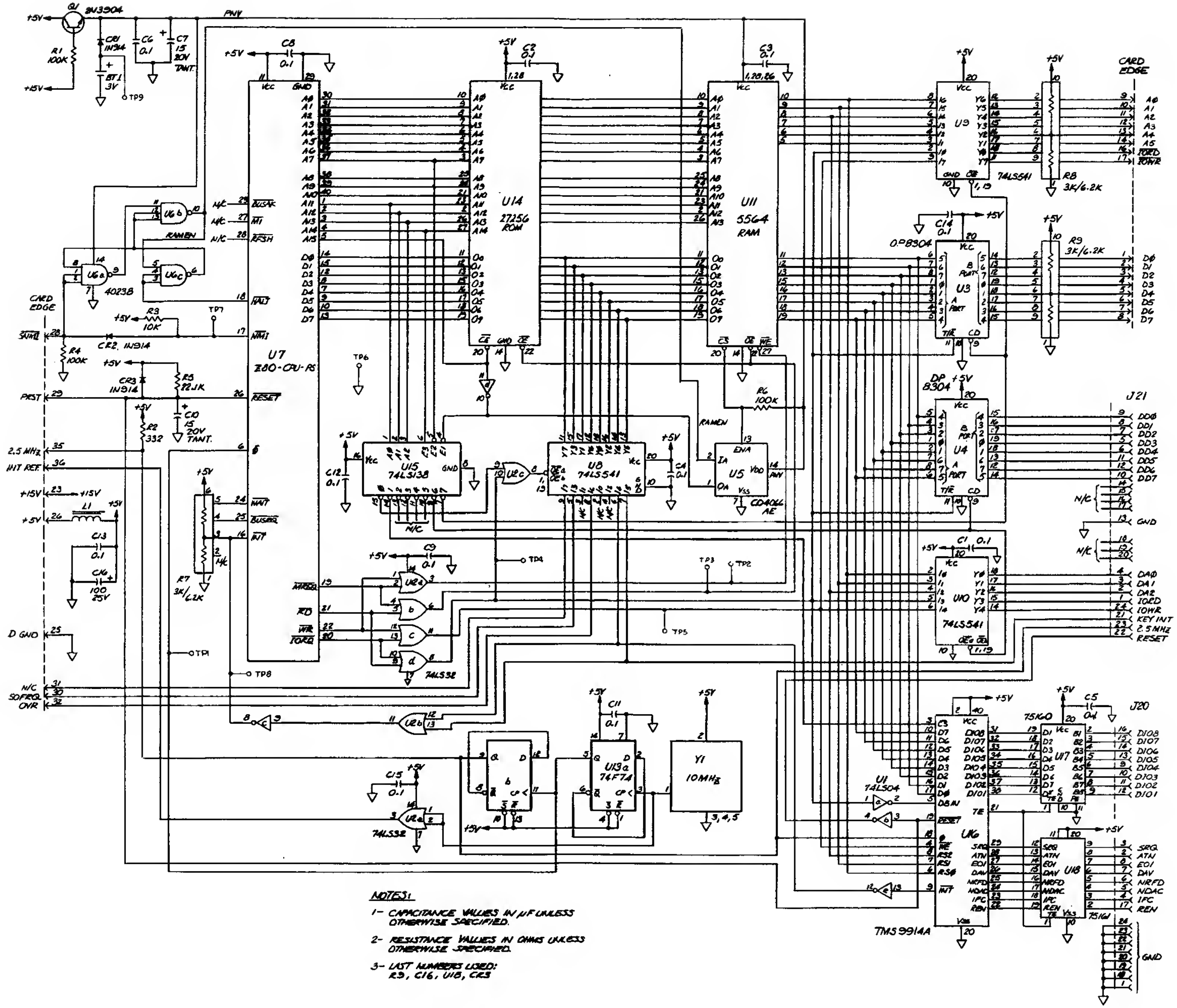


Figure 7-16. C.P.U Board A5 Schematic

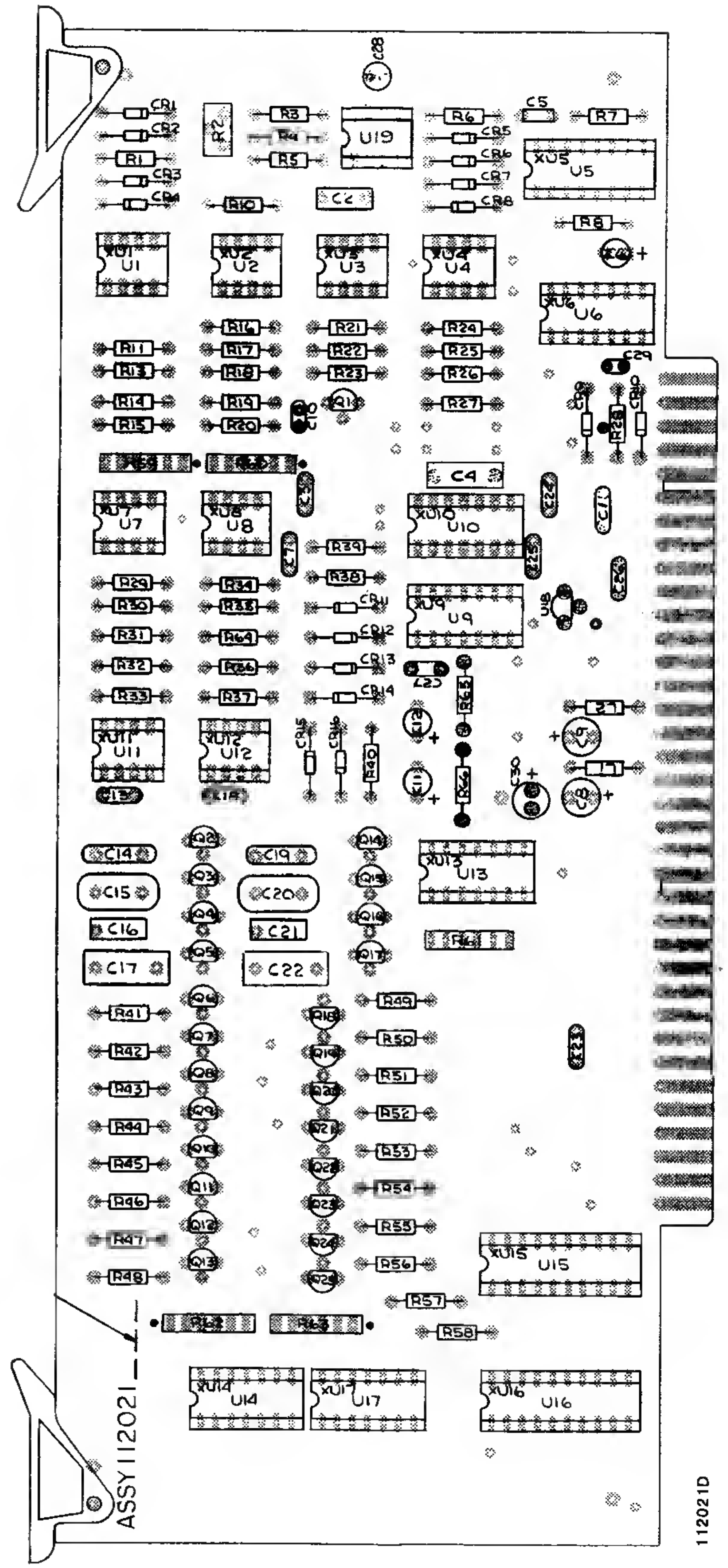


Figure 7-17. Source Board A6 Parts Location Diagram

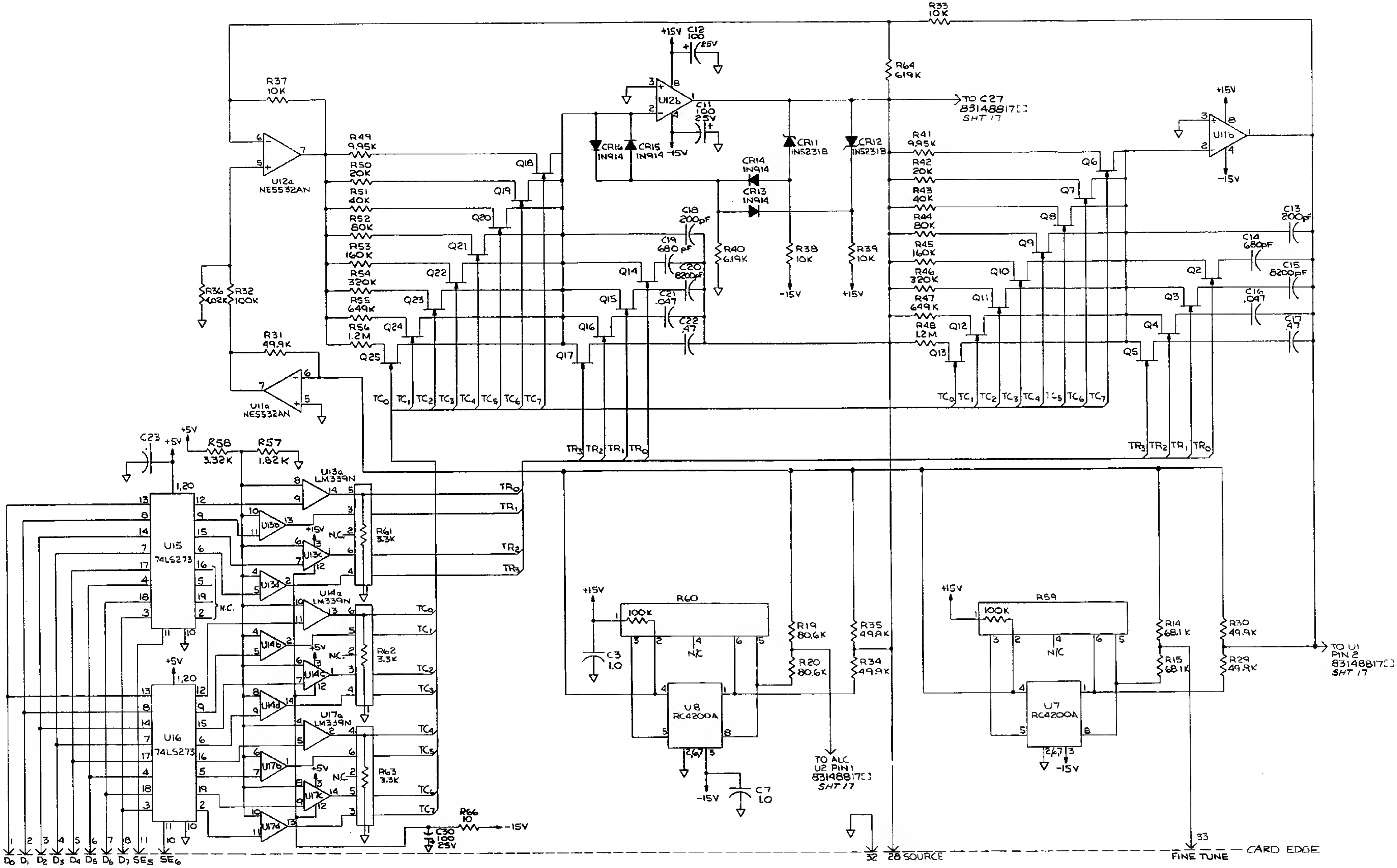


Figure 7-18. Source Board A6 Schematic (Sheet 1 of 2)

NOTE:

1. FET TRANSISTOR Q6-Q13, Q18-Q25 ARE TYPE 2N5653,
2. FET TRANSISTOR Q2-Q5, Q14-Q17 ARE TYPE J108.

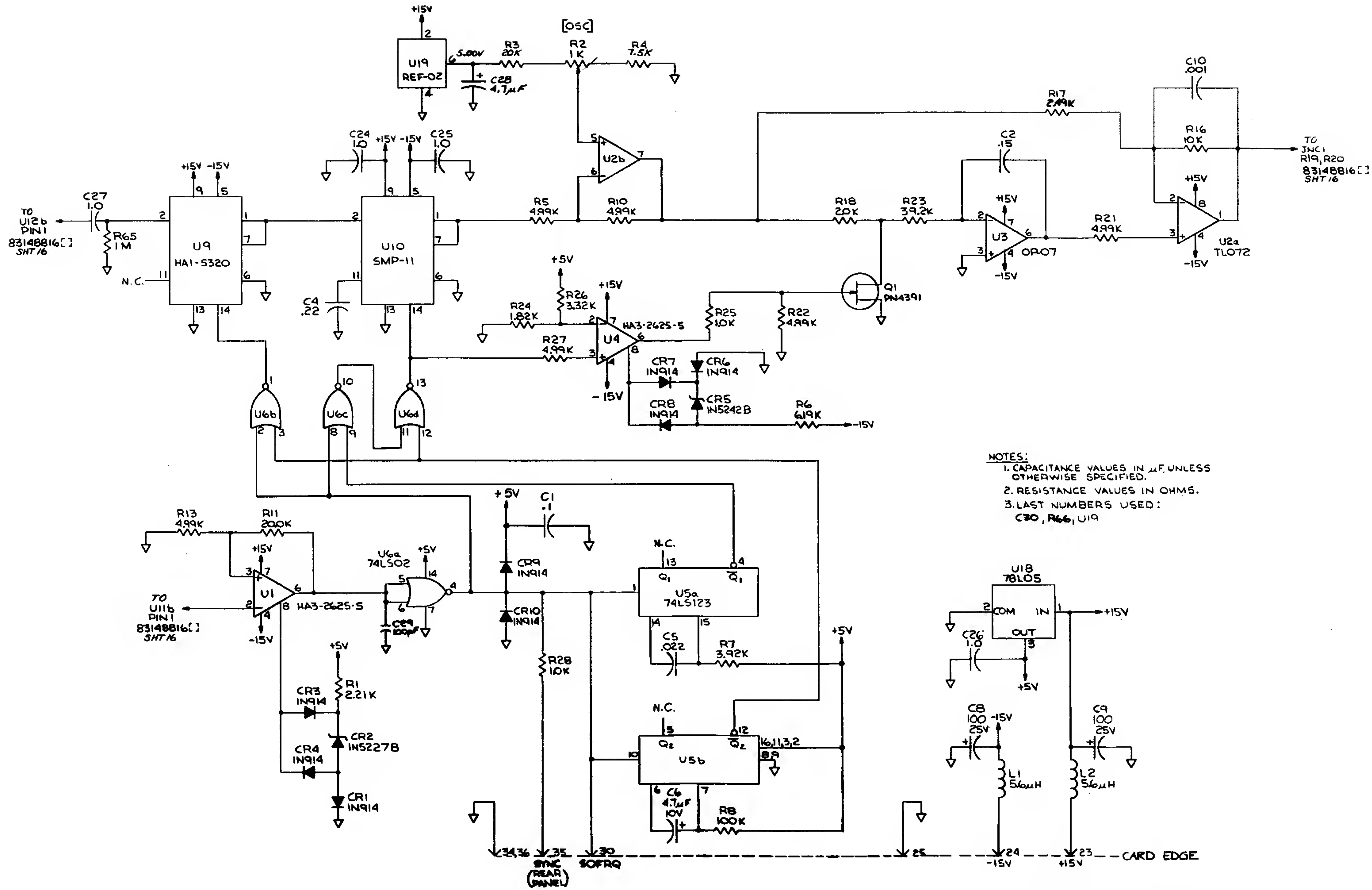


Figure 7-19. Source Board A6 Schematic (Sheet 2 of 2)

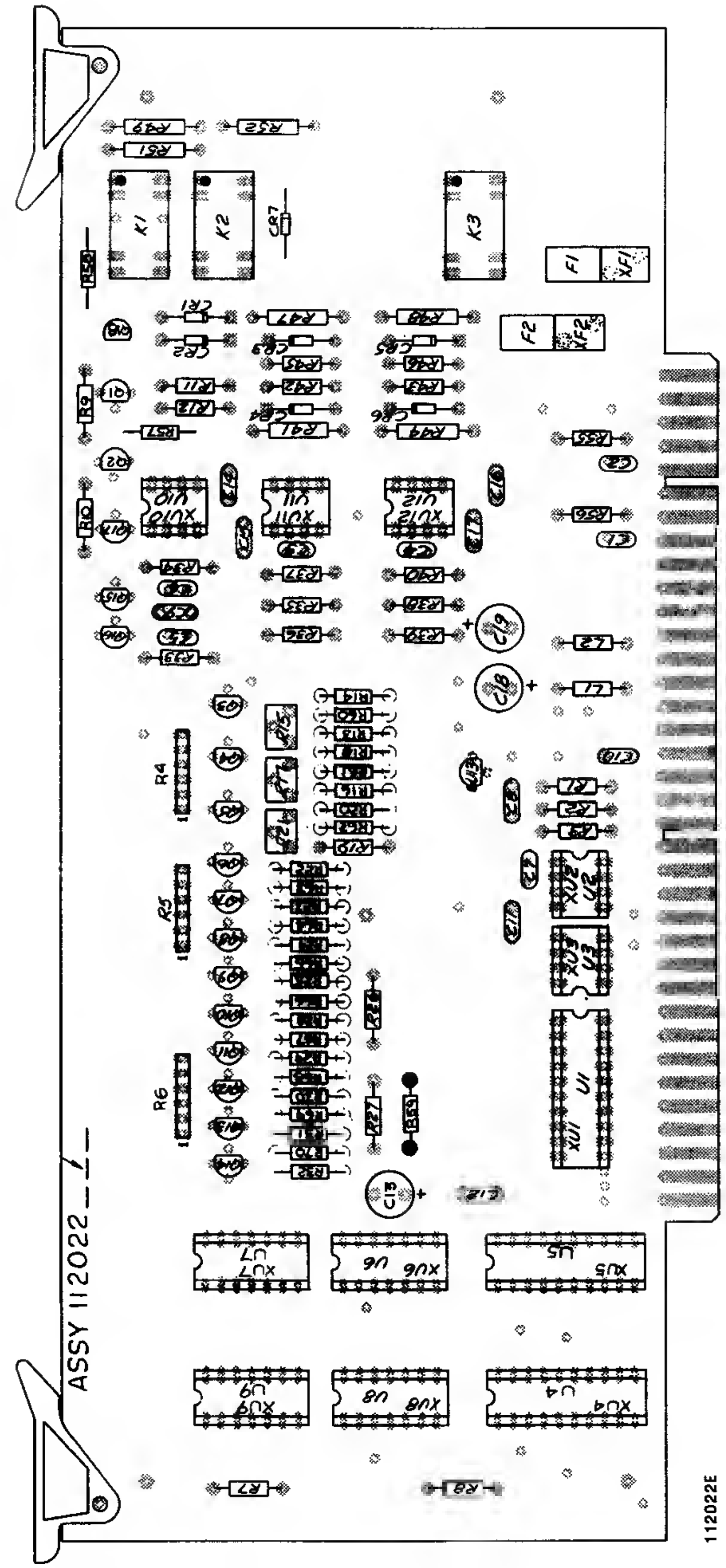
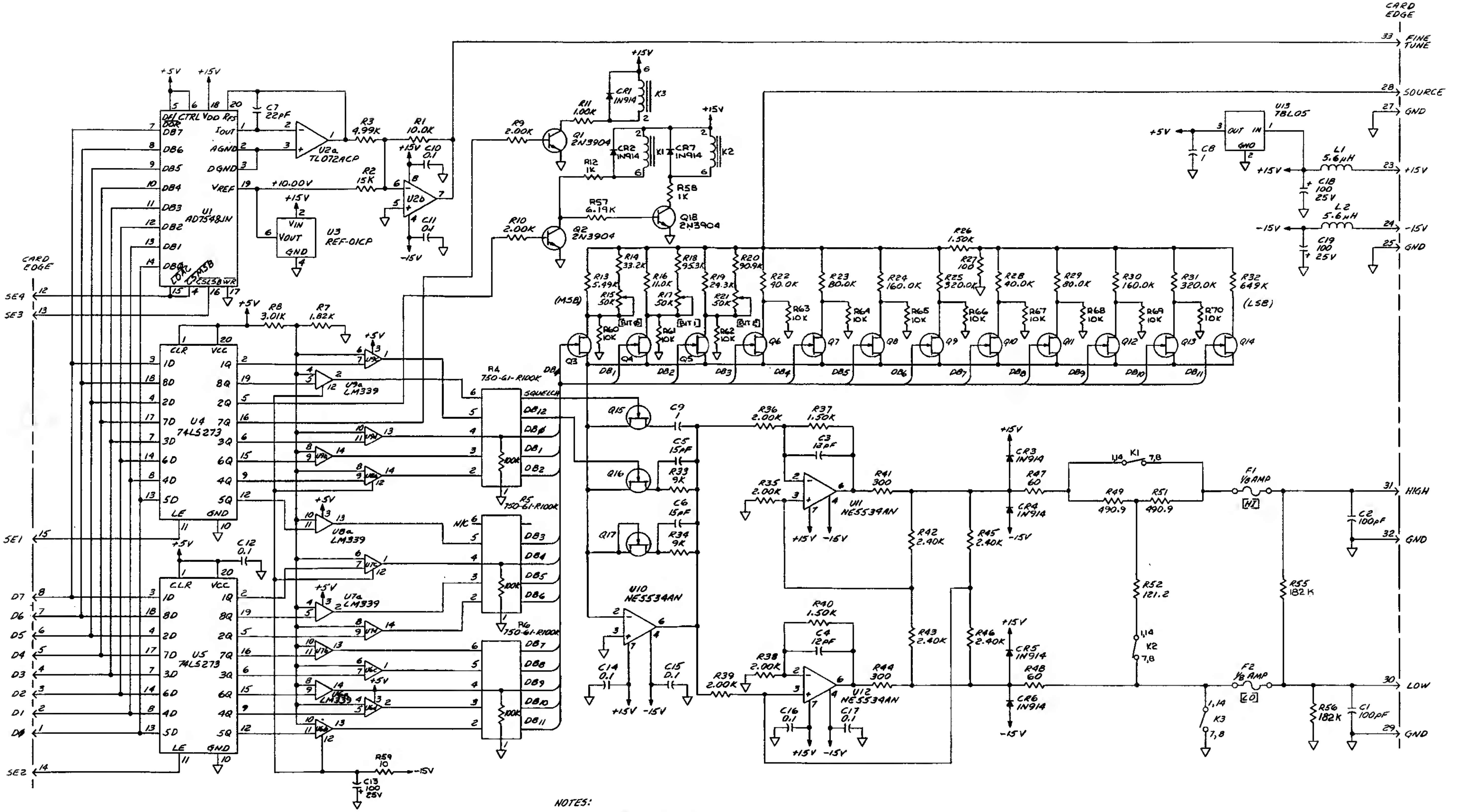


Figure 7-20. Output Board A7 Parts Location Diagram



NOTES:

1. CAPACITANCE VALUES IN µF, UNLESS OTHERWISE SPECIFIED.
2. RESISTANCE VALUES IN OHMS.
3. TRANSISTORS TO BE TYPE 2N5653, MOTOROLA ONLY, UNLESS OTHERWISE SPECIFIED.
4. NUMBERS NOT USED:
   R50 R53 R54
5. LAST NUMBER USED:
   C19 R70 Q18 CR7 U13

Figure 7-21. Output Board A7 Schematic

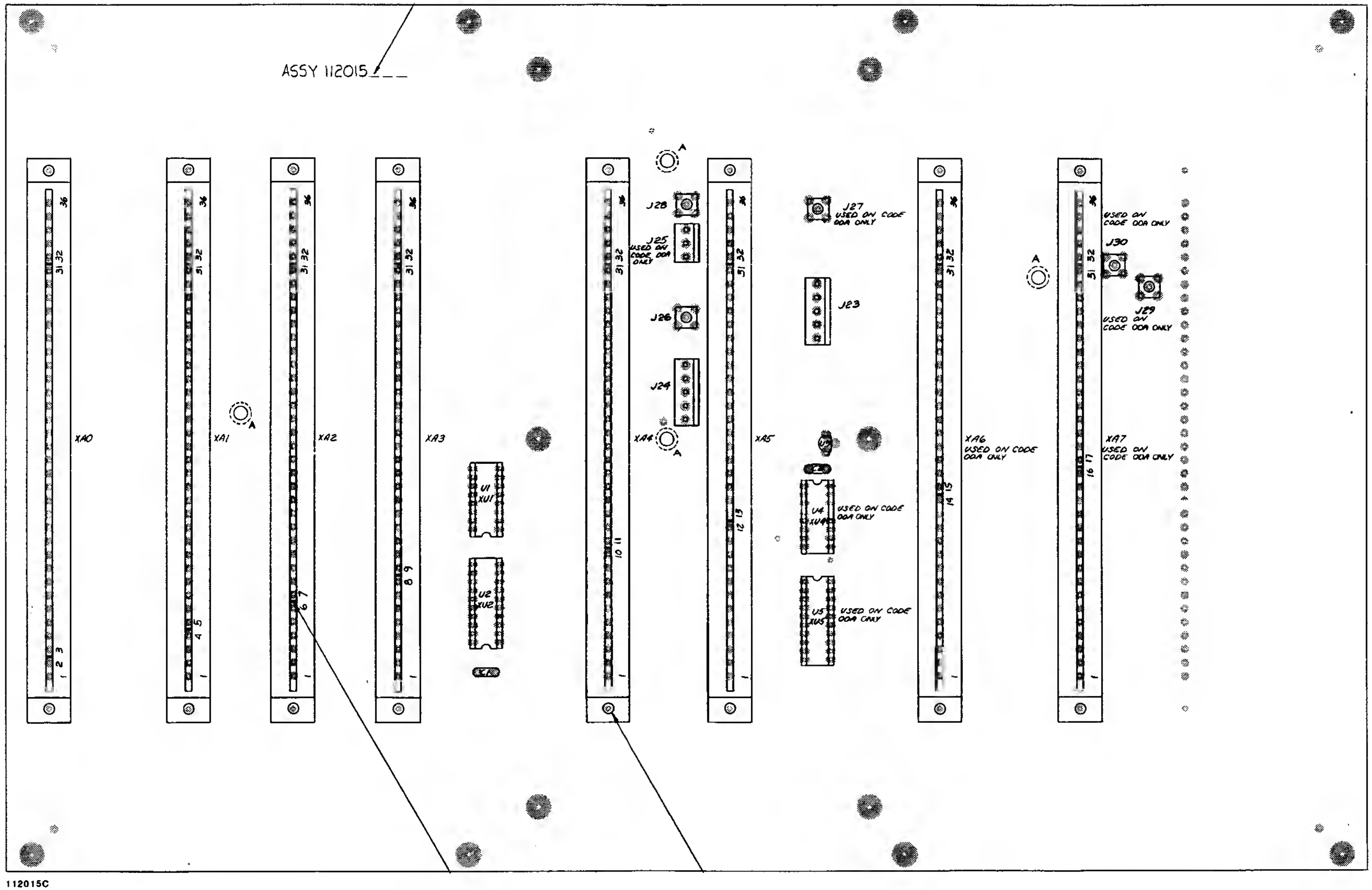
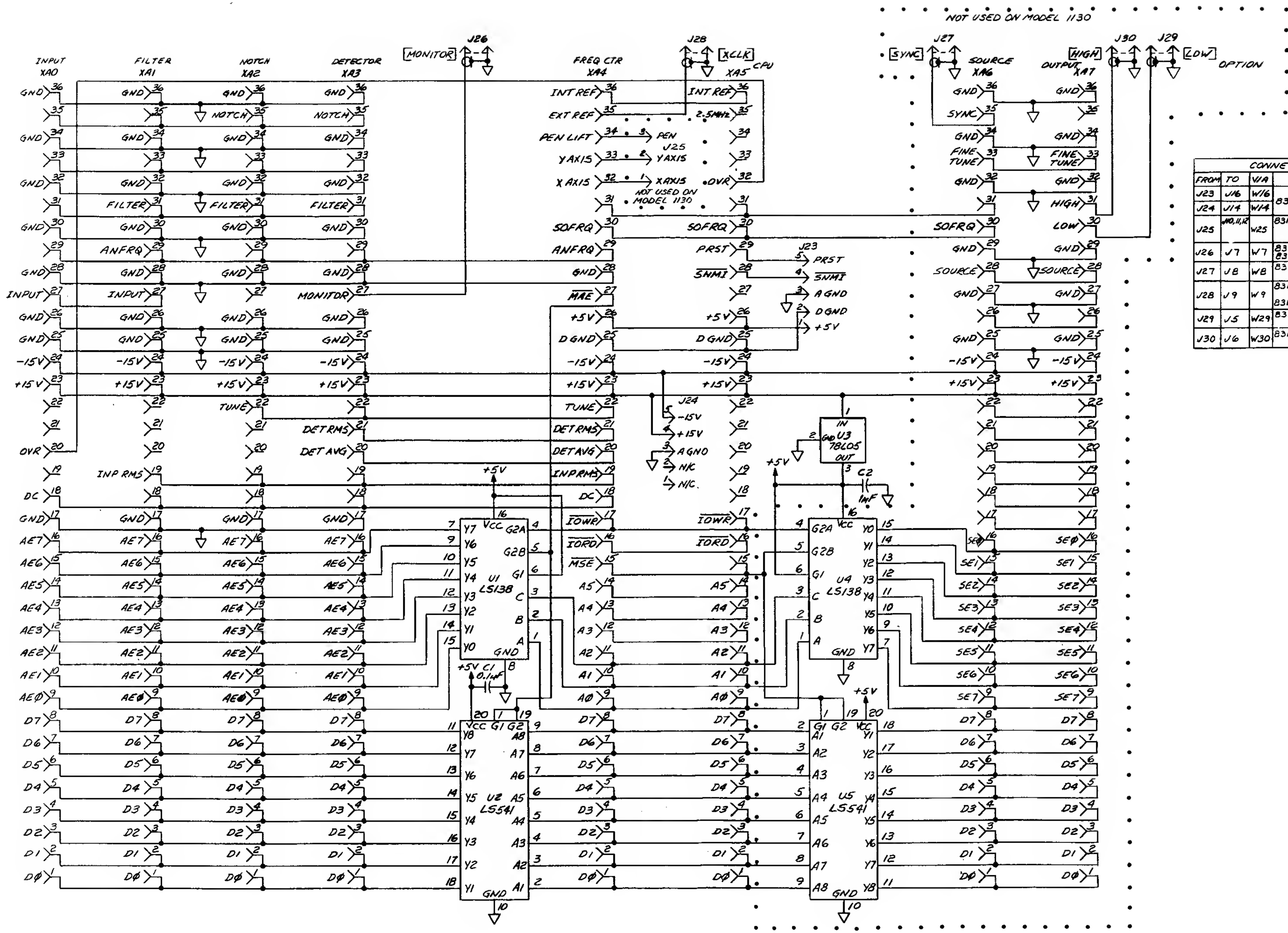


Figure 7-22. Mother Board A10 Parts Location Diagram



CONNECT TO FROM LIST			
FROM	TO	VIA	SCHEMATIC
J23	J16	W16	83148803 PWR SUPPLY
J24	J14	W14	
J25	J10,11,12	W25	83148802 FRAME (1120 ONLY)
J26	J7	W7	83148802 FRAME (1120 ONLY) 83148821 FRAME (1130 ONLY)
J27	J8	W8	83148802 FRAME (1120 ONLY)
J28	J9	W9	83148802 FRAME (1120 ONLY) 83148821 FRAME (1130 ONLY)
J29	J5	W29	83148802 FRAME (1120 ONLY)
J30	J6	W30	83148802 FRAME (1120 ONLY)

Figure 7-23. Mother Board A10 Schematic

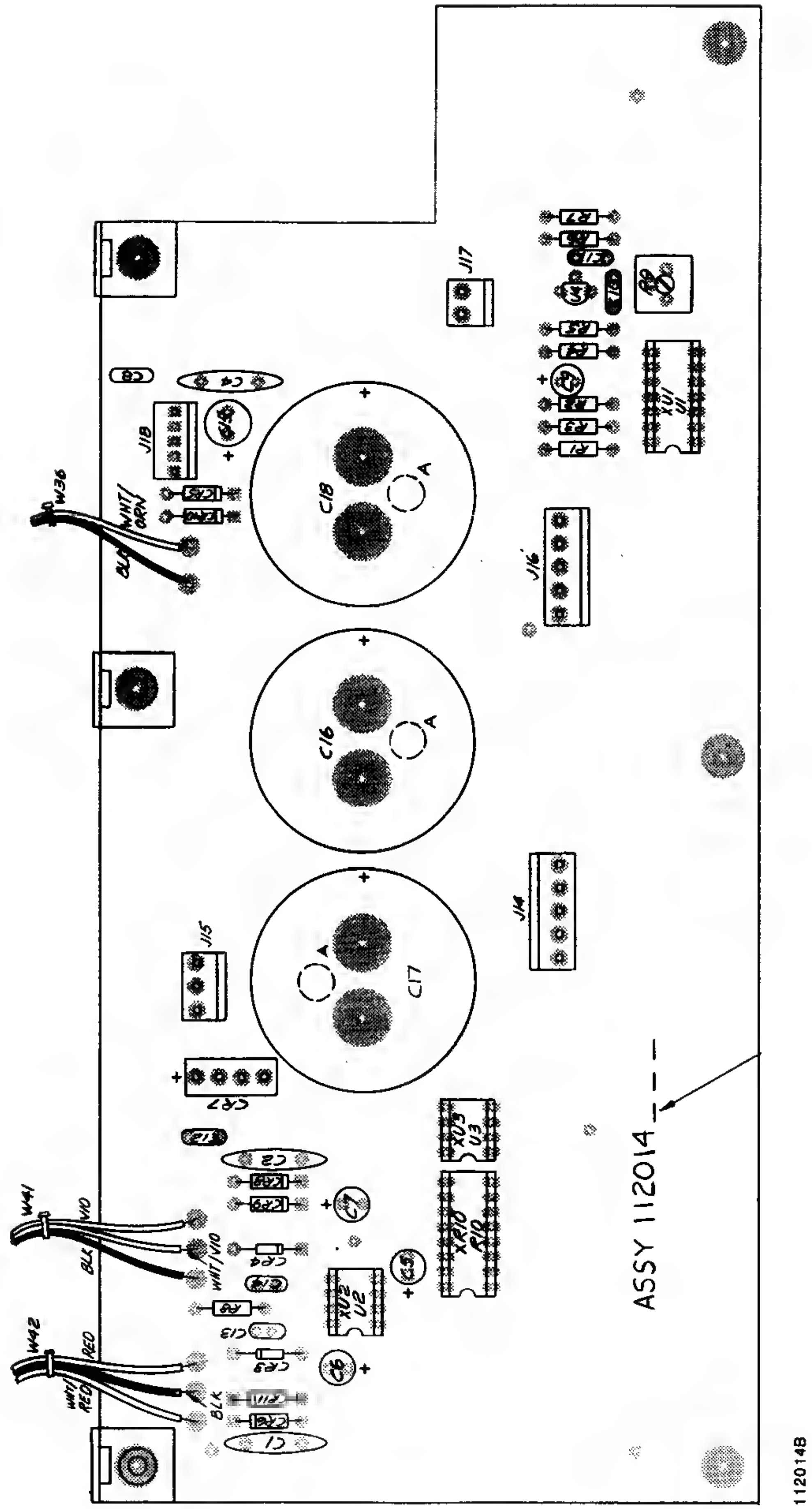
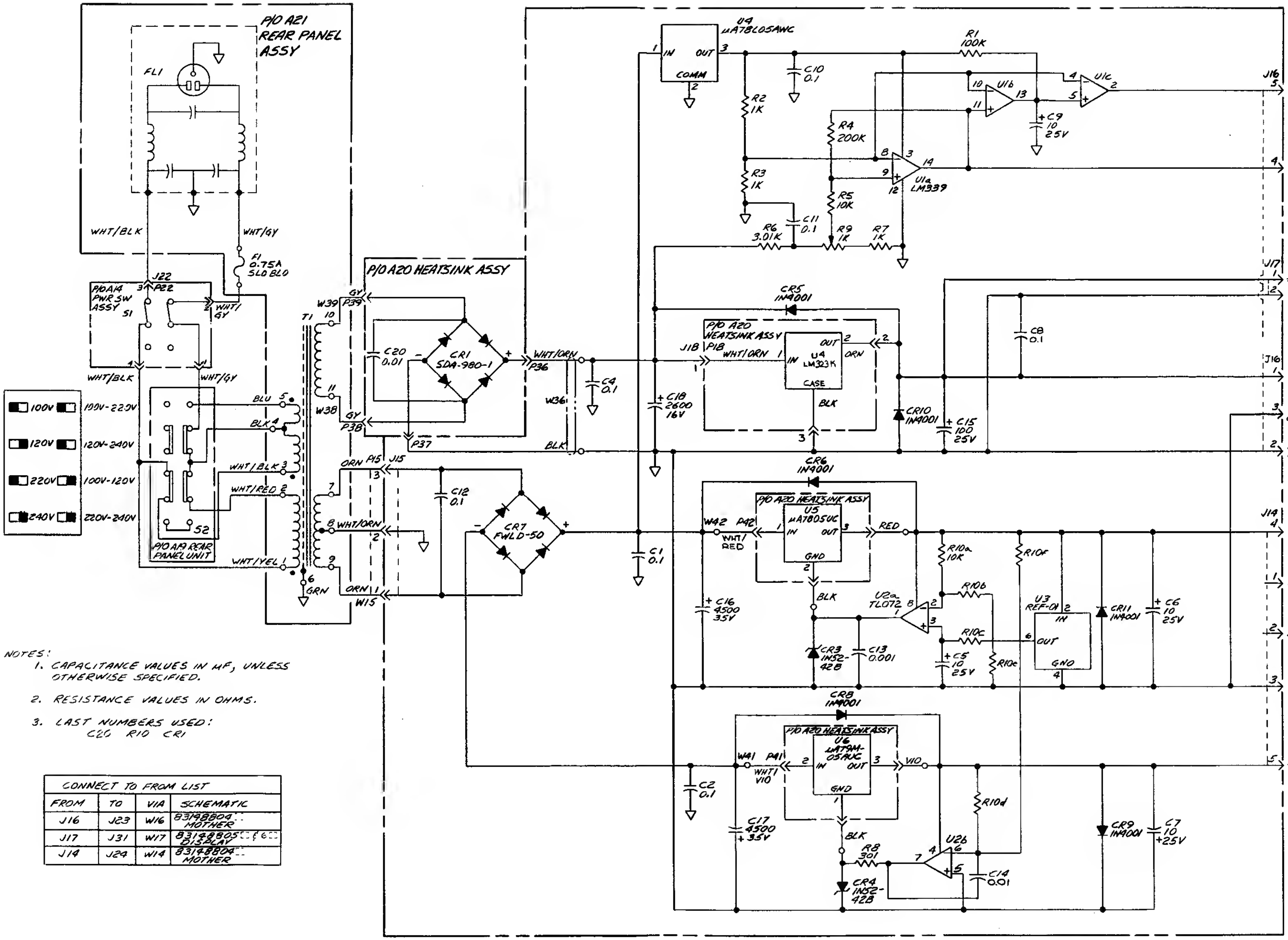


Figure 7-24. Power Supply Board A11 Parts Location Diagram



NOTES:

1. CAPACITANCE VALUES IN μF, UNLESS OTHERWISE SPECIFIED.
2. RESISTANCE VALUES IN OHMS.
3. LAST NUMBERS USED:
   C20 R10 CR1

CONNECT TO FROM LIST			
FROM	TO	VIA	SCHEMATIC
J16	J23	W16	83198804 MOTHER
J17	J31	W17	83198805 DISPLAY
J14	J24	W14	83198804 MOTHER

Figure 7-25. Power Supply Board A11 Schematic

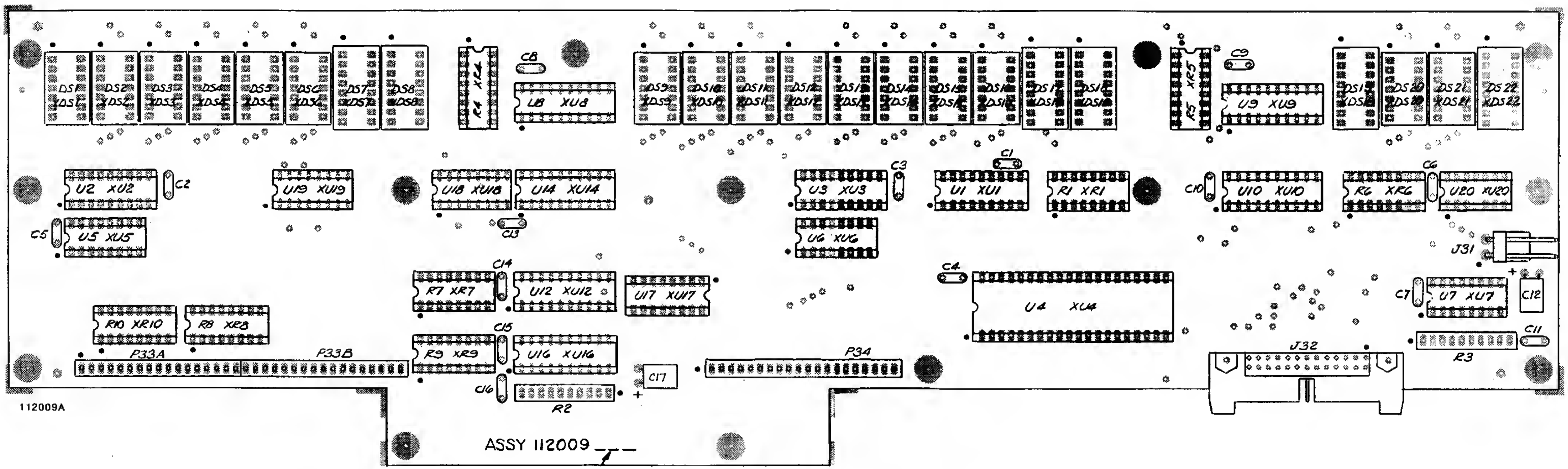
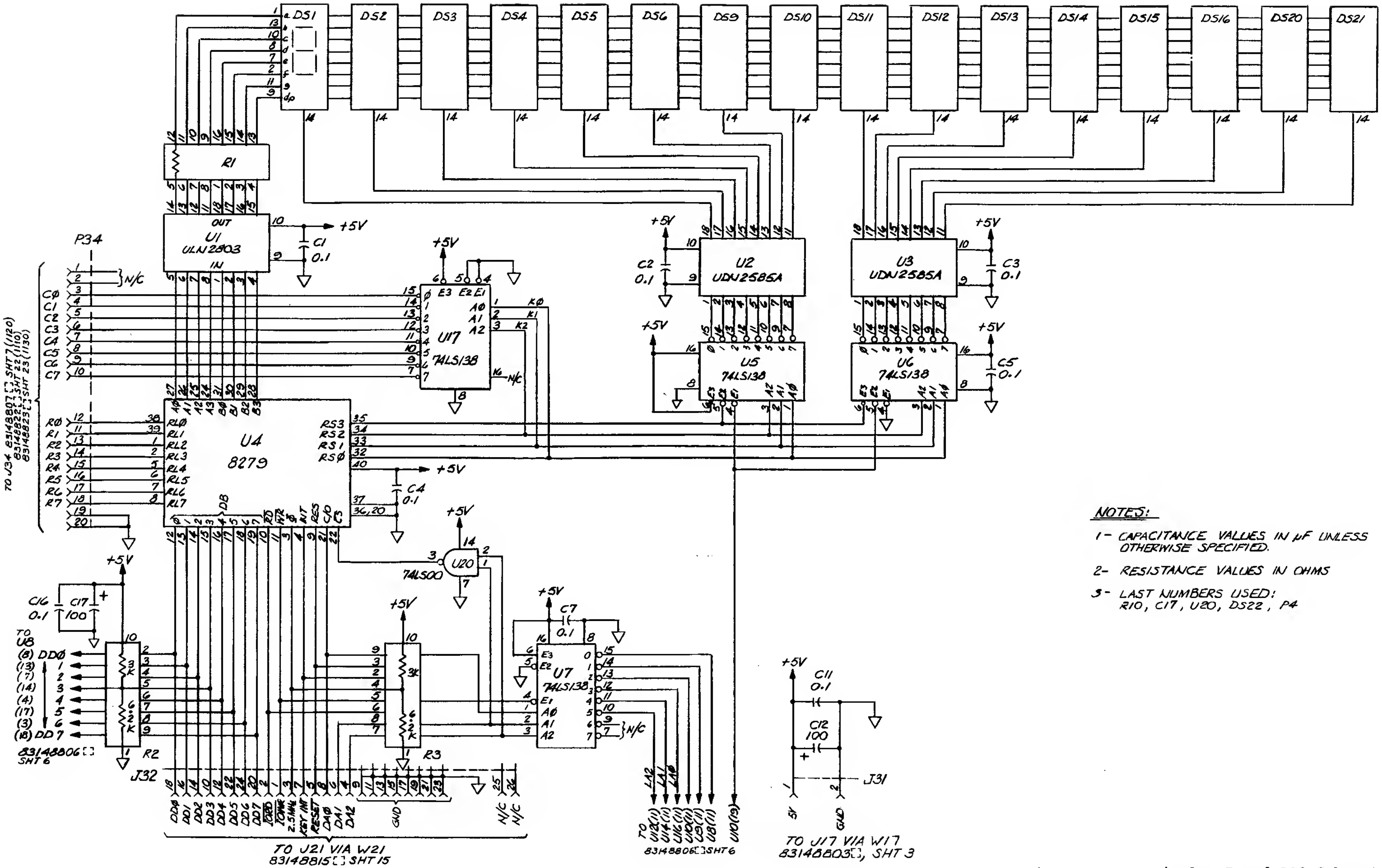


Figure 7-26. Display Board A12 Parts Location Diagram



NOTES:

1- CAPACITANCE VALUES IN µF UNLESS OTHERWISE SPECIFIED.

2- RESISTANCE VALUES IN OHMS

3- LAST NUMBERS USED: R10, C17, U20, DS22, P4

Figure 7-27. Display Board A12 Schematic (Sheet 1 of 2)

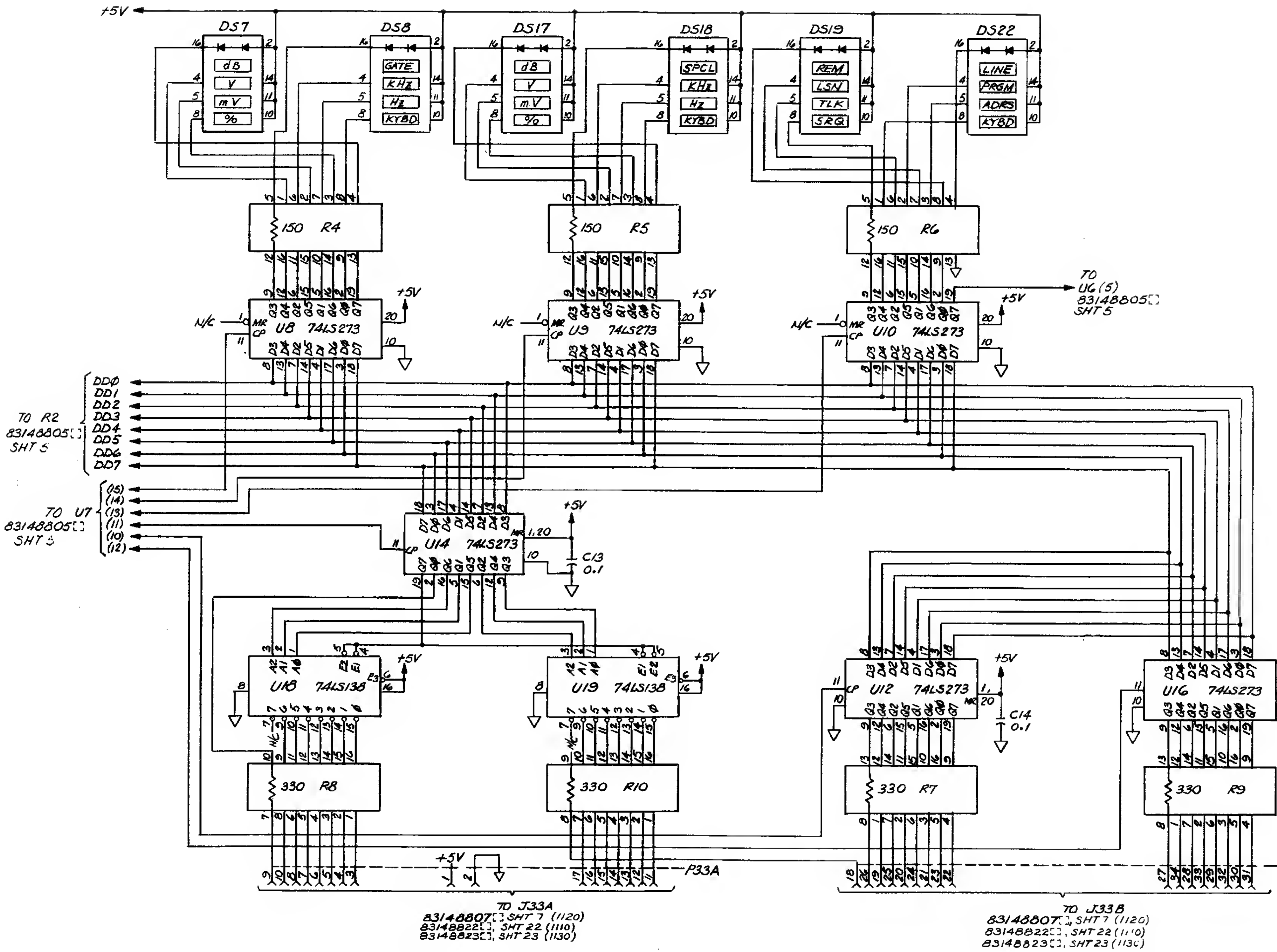


Figure 7-28. Display Board A12 Schematic (Sheet 2 of 2)

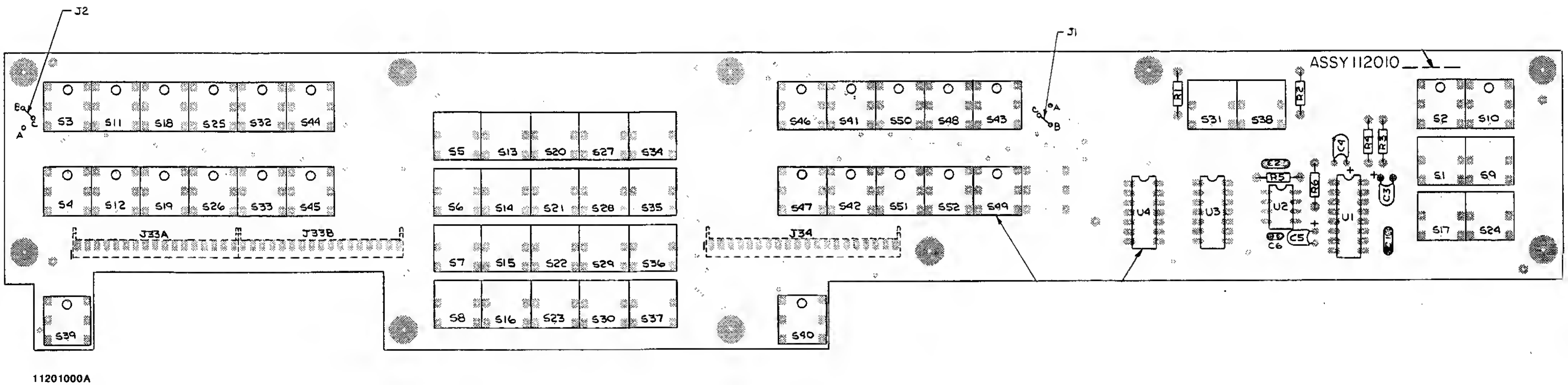


Figure 7-29. Key Board A13 Parts Location Diagram

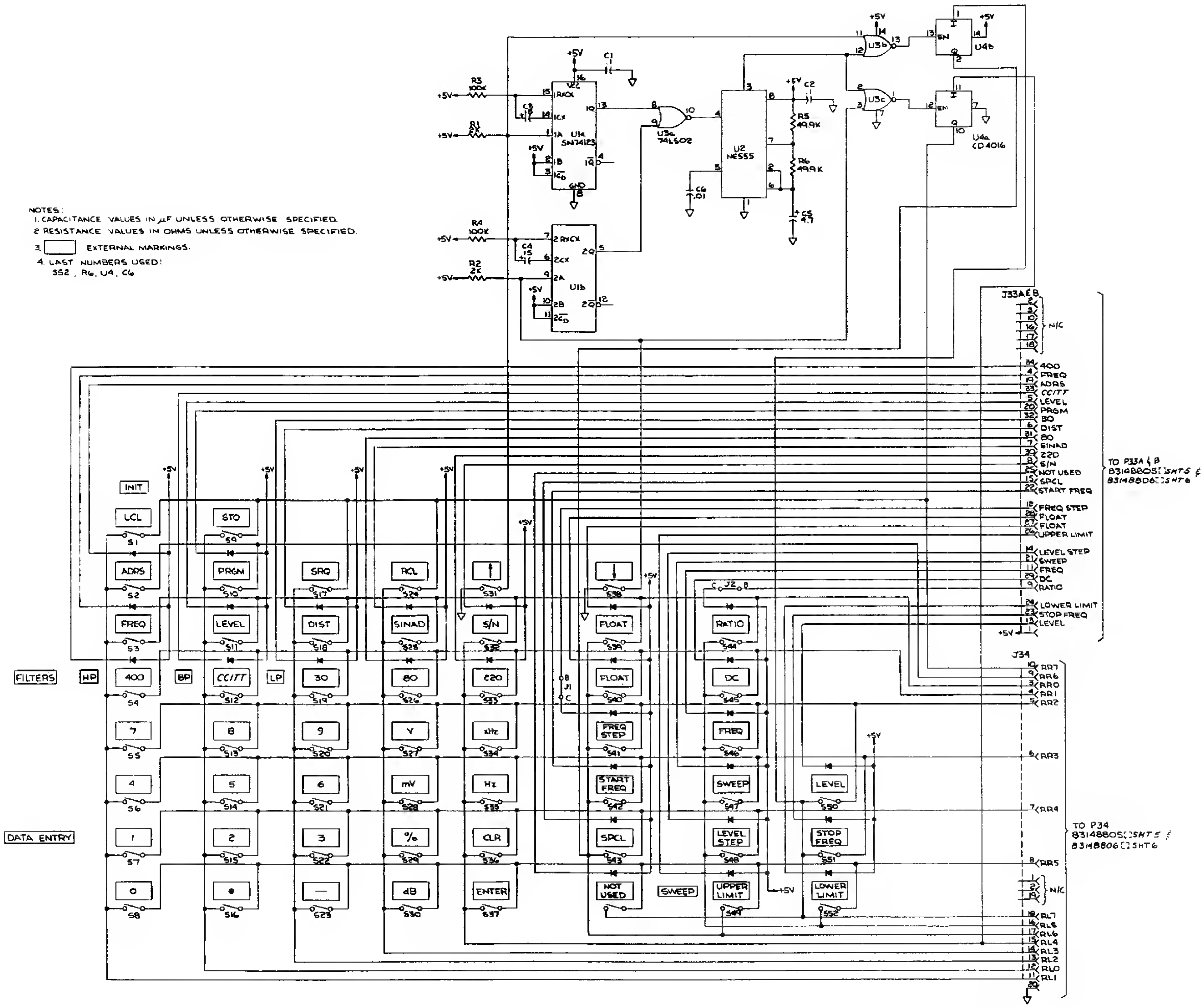


Figure 7-30. Key Board A13 Schematic

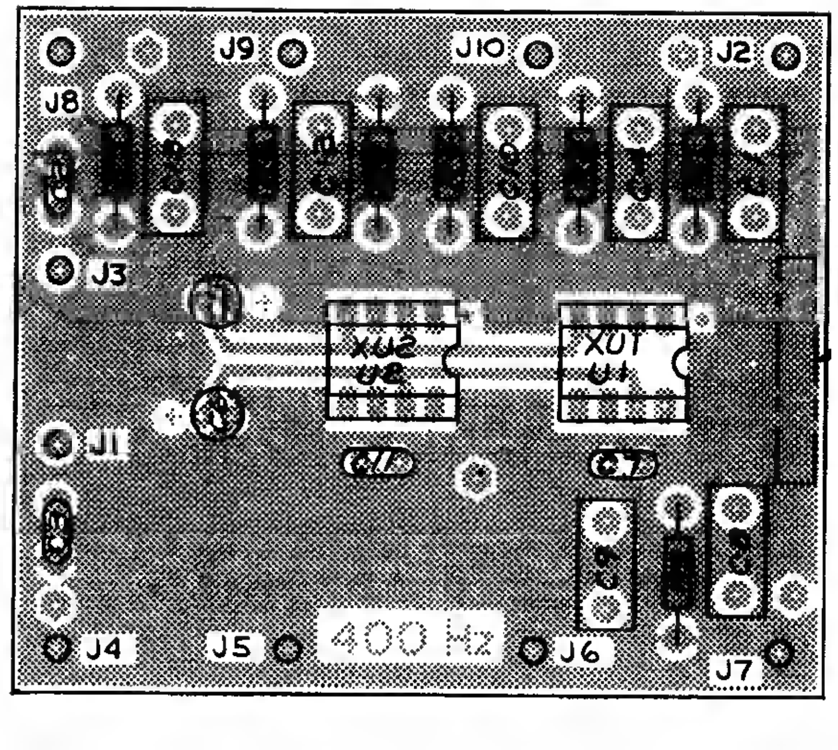


Figure 7-31. 400 Hz Board A1A30 Parts Location Diagram

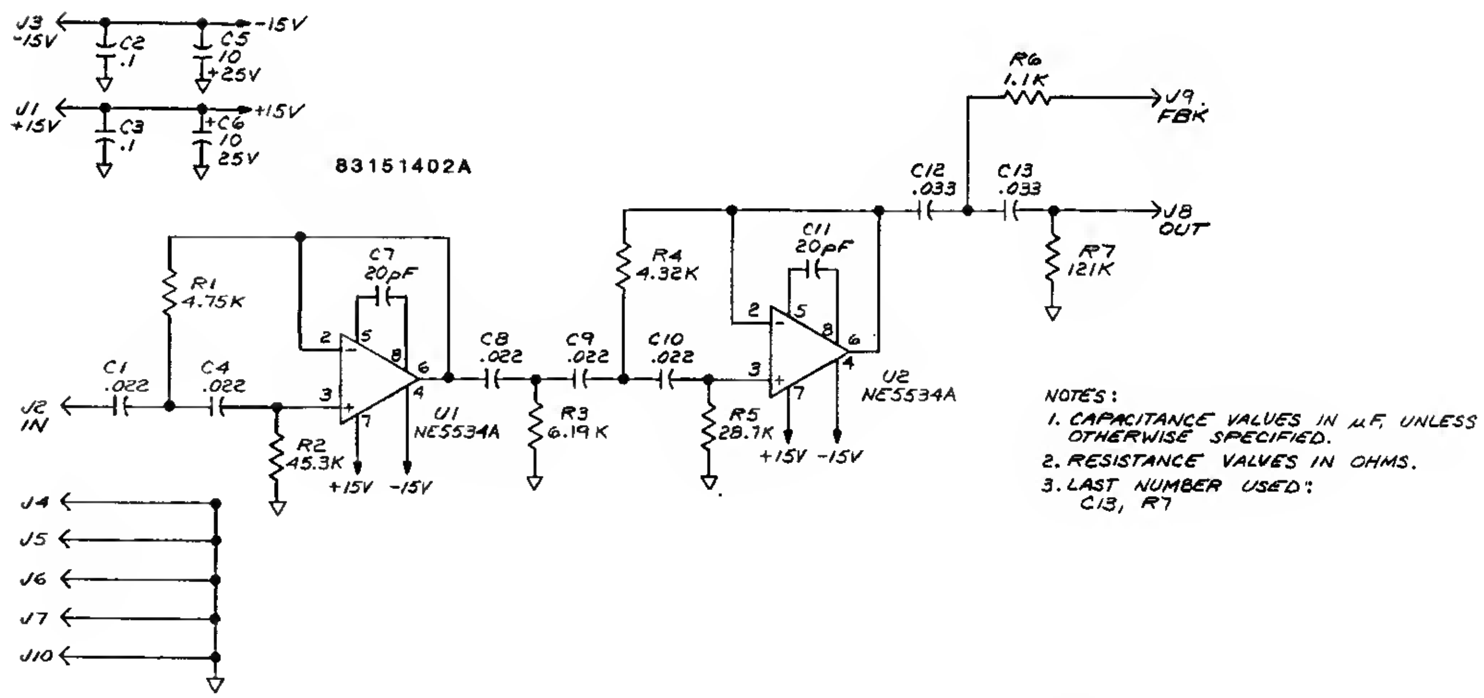
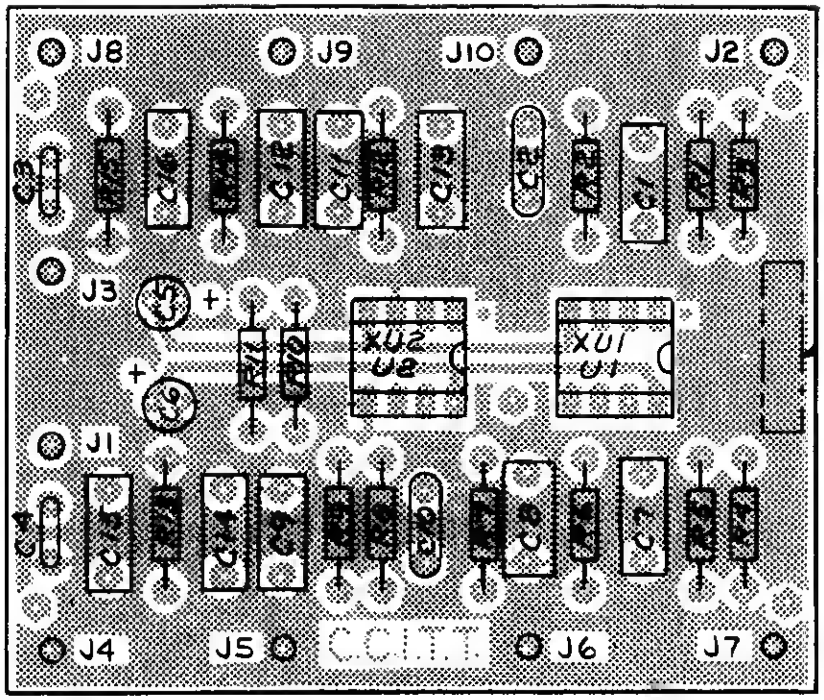
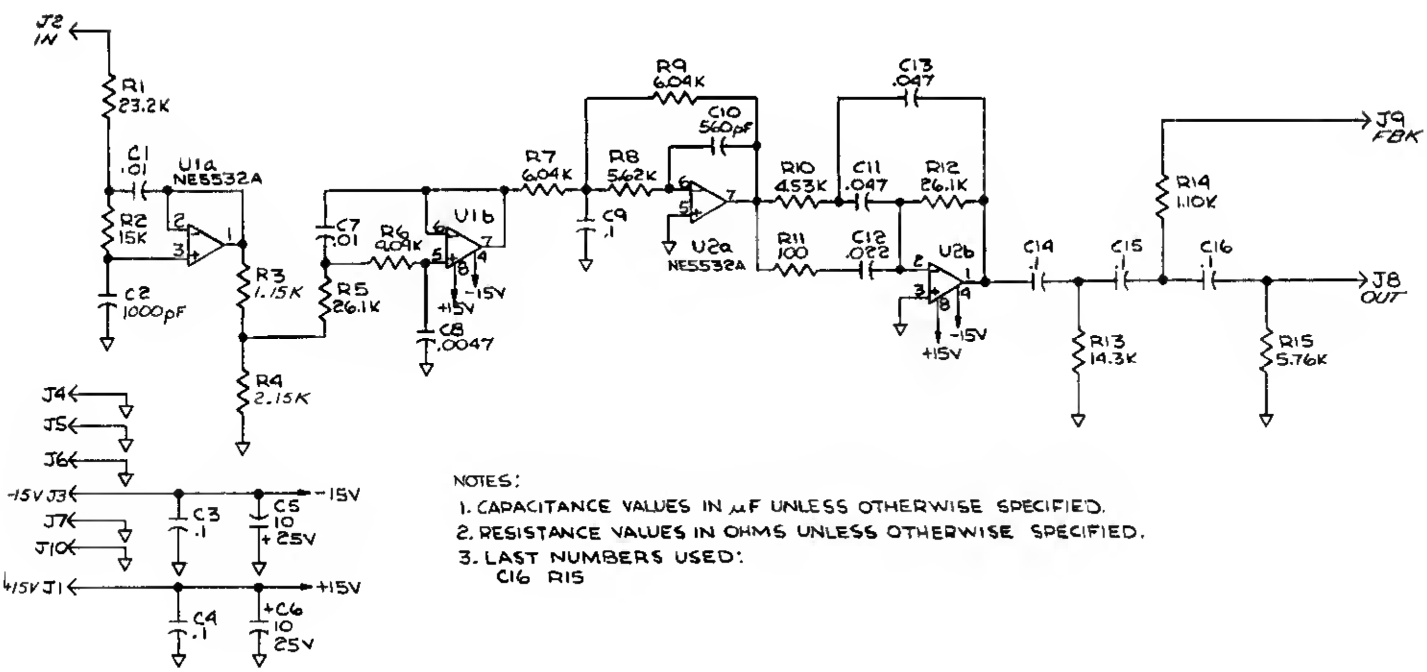


Figure 7-32. 400 Hz Board A1A30 Schematic



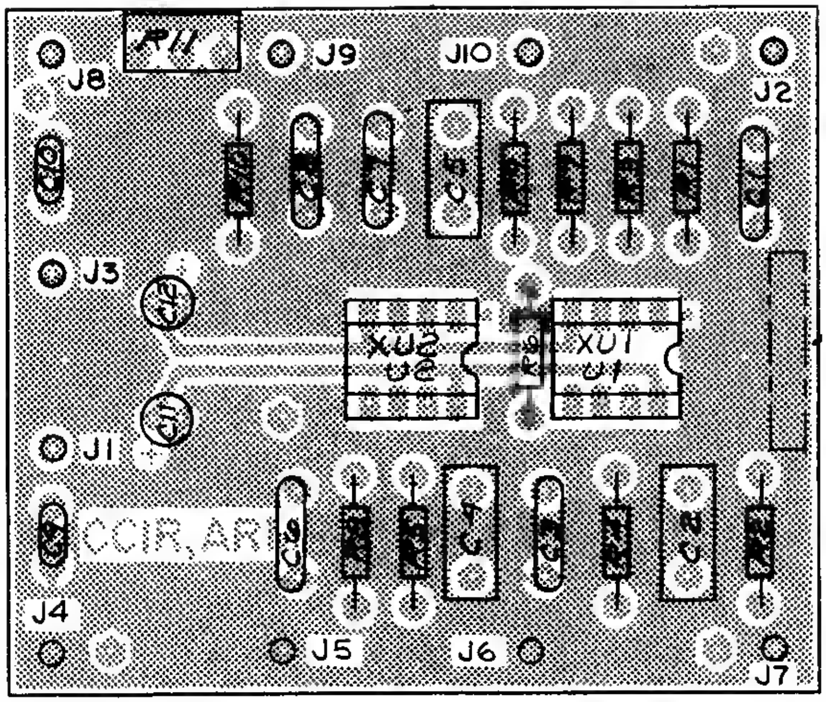
112040A

Figure 7-33. CCITT Board A1A31 Parts Location Diagram



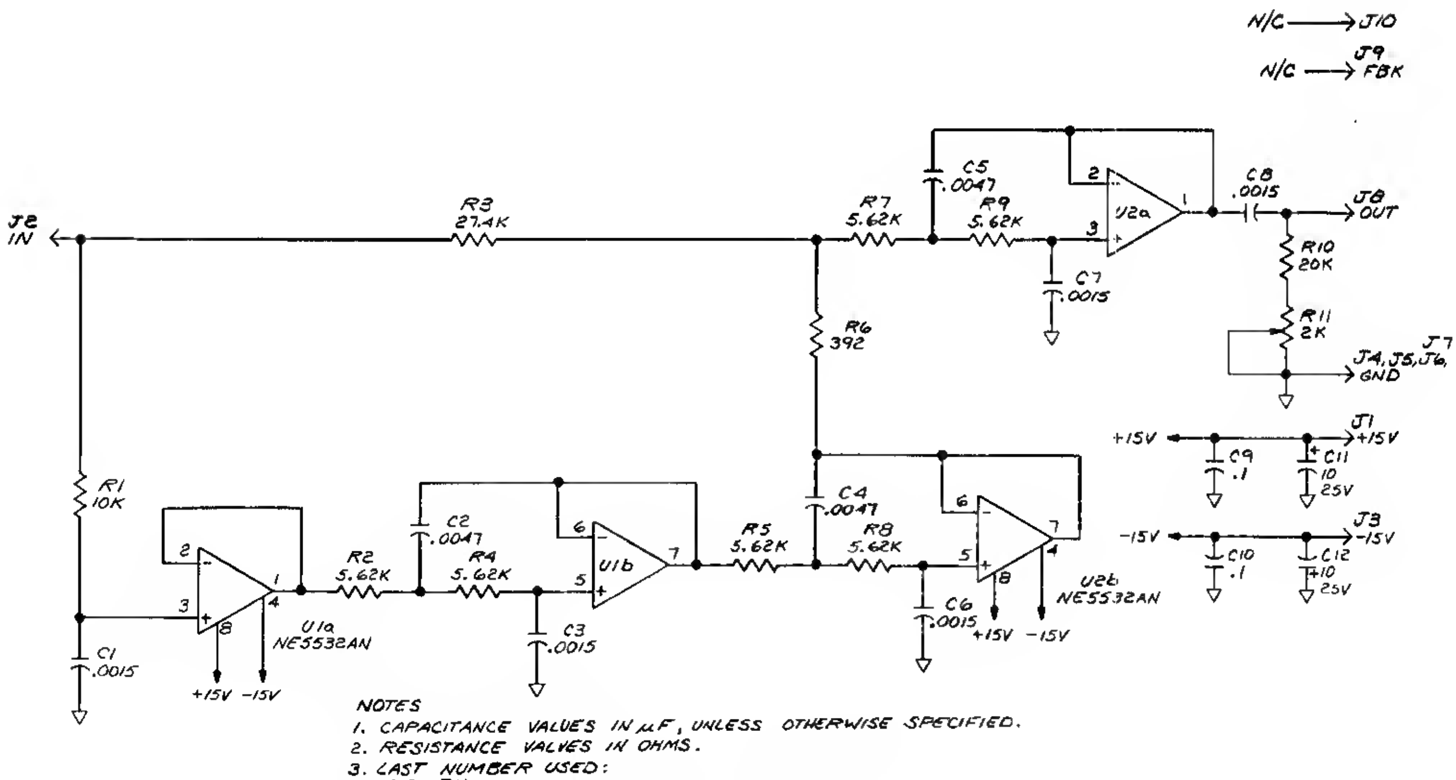
83151403A

Figure 7-34. CCITT Board A1A31 Schematic



112037A

Figure 7-35. CCIR Board A1A32,A33 Parts Location Diagram



83151404A

Figure 7-36. CCIR Board A1A32,A33 Schematic

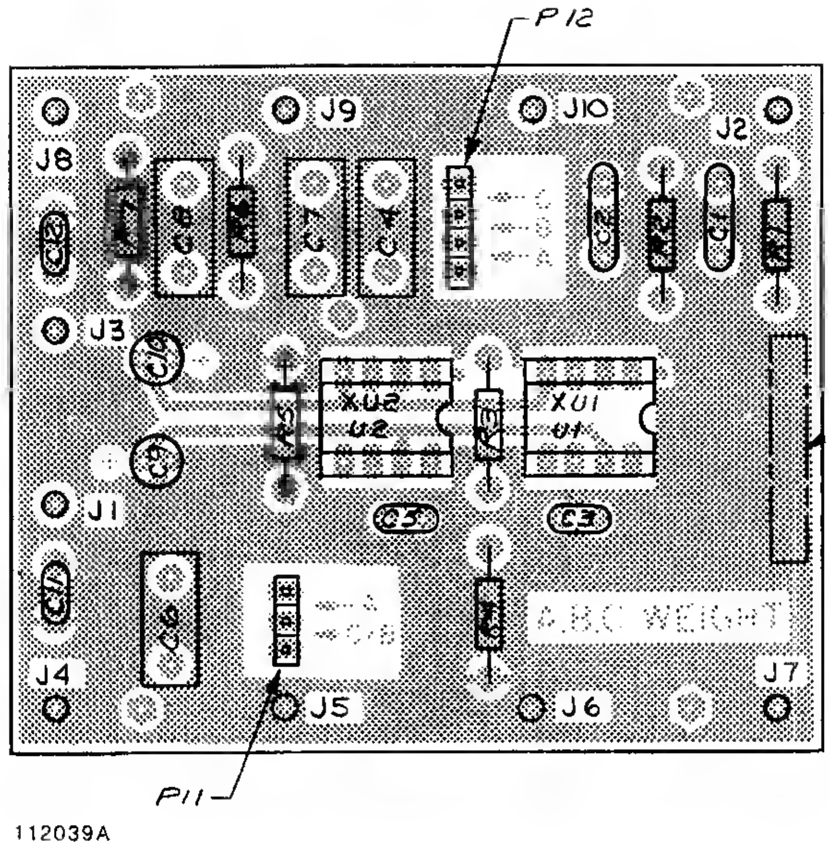


Figure 7-37. A,B,C WTNG Board A1A34,A35,A36
Parts Location Diagram

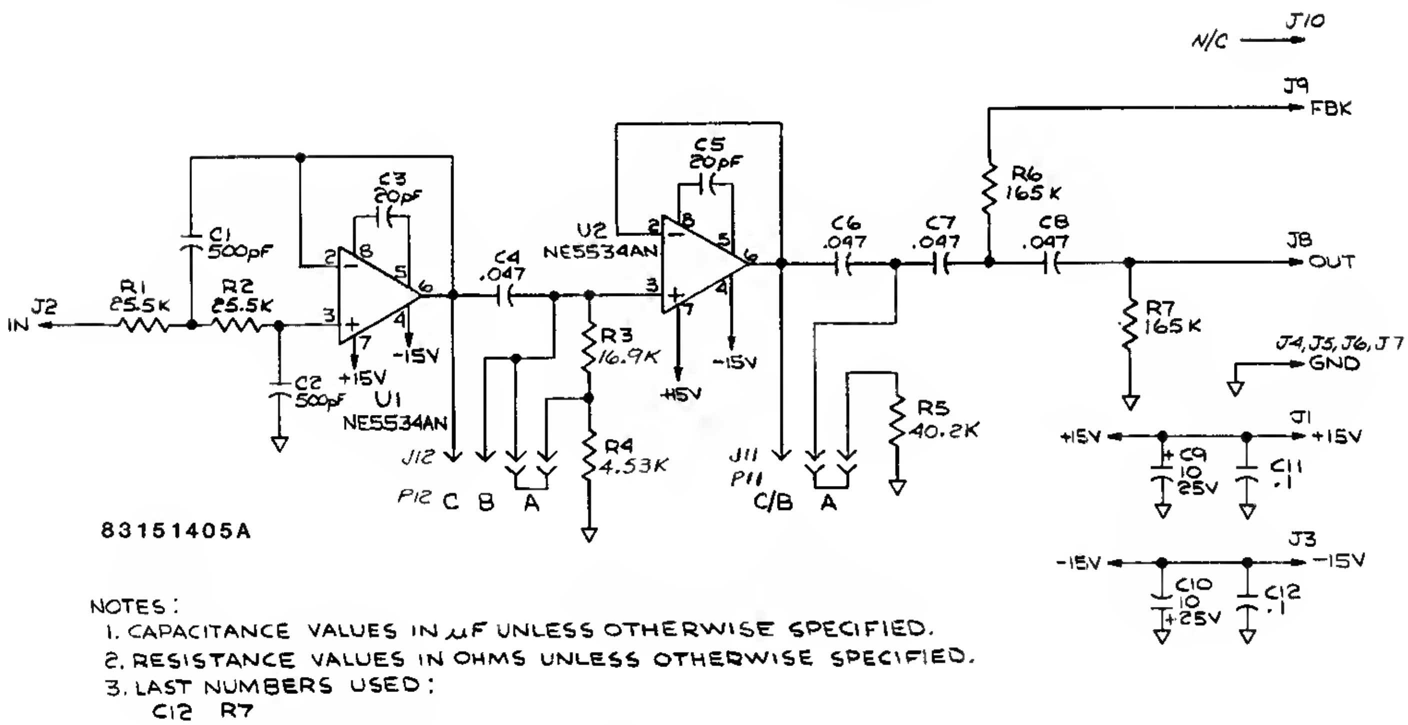
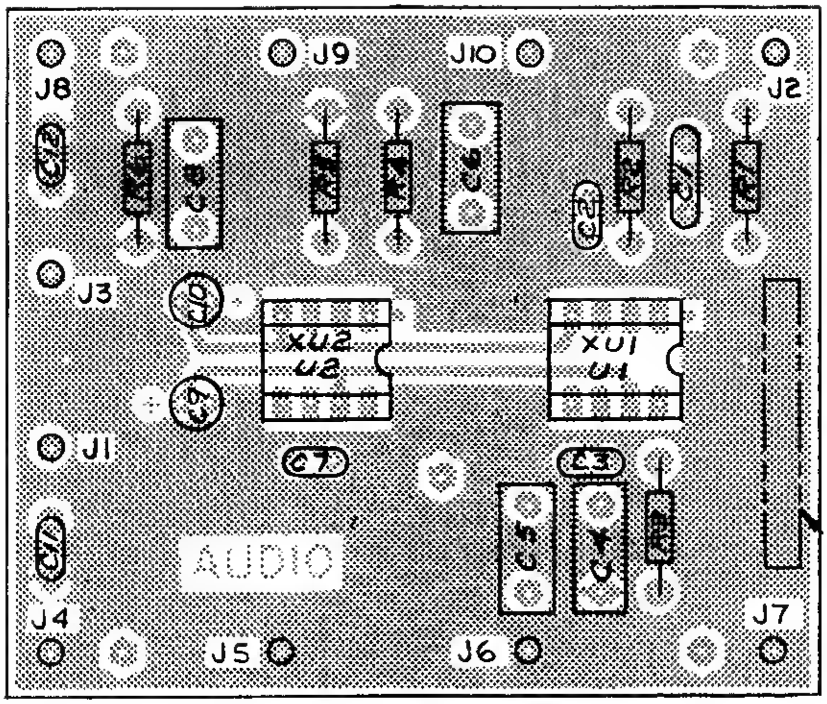
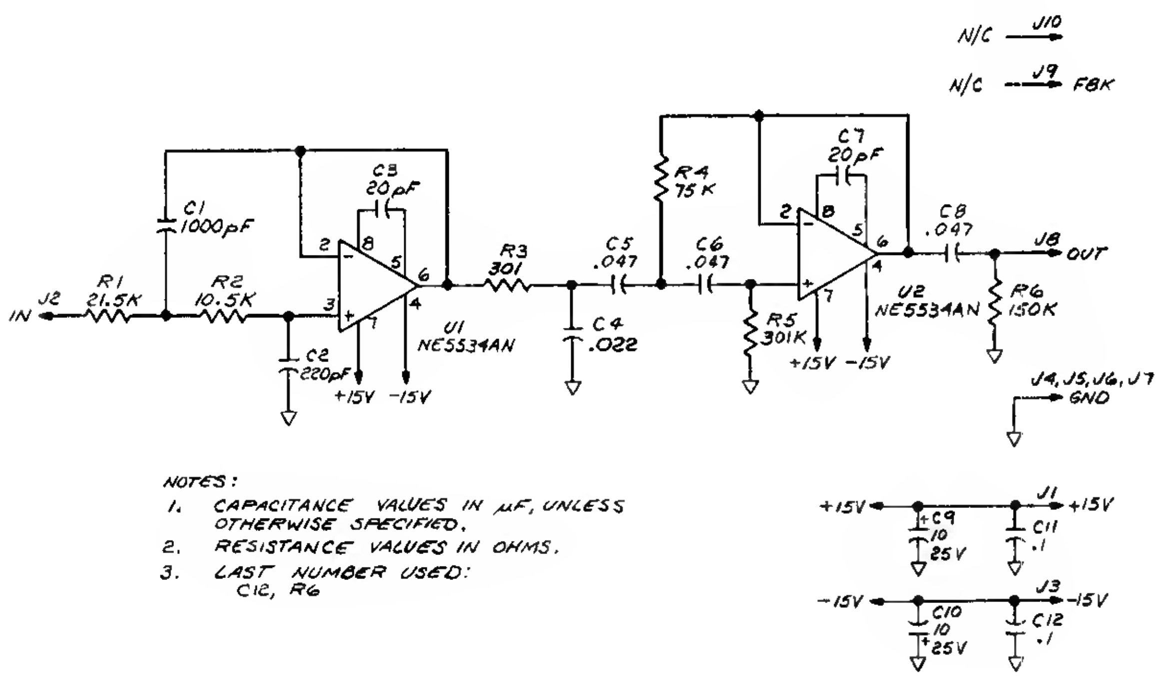


Figure 7-38. A,B,C WTNG Board A1A34,A35,A36 Schematic



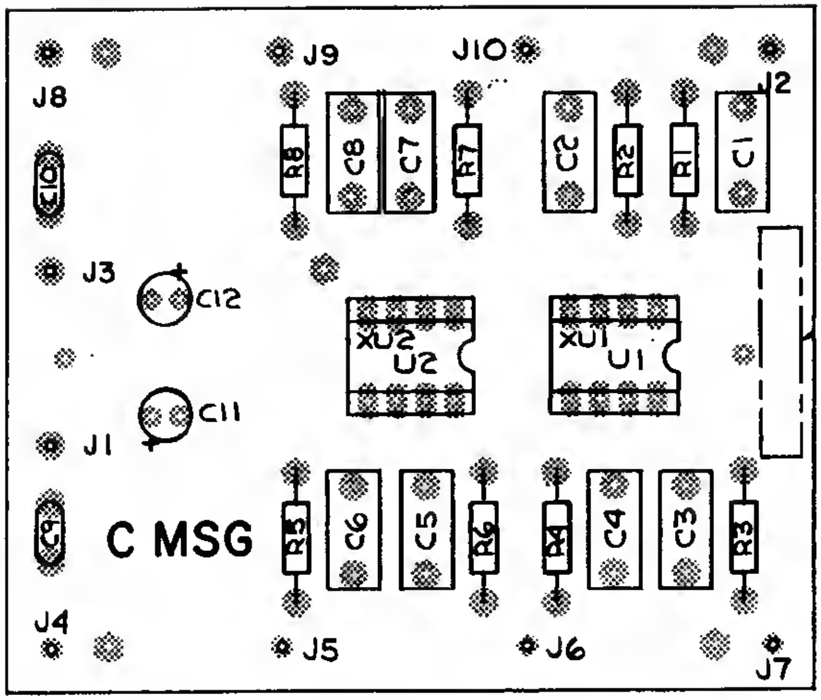
112036A

Figure 7-39. AUDIO Board A1A37 Parts Location Diagram



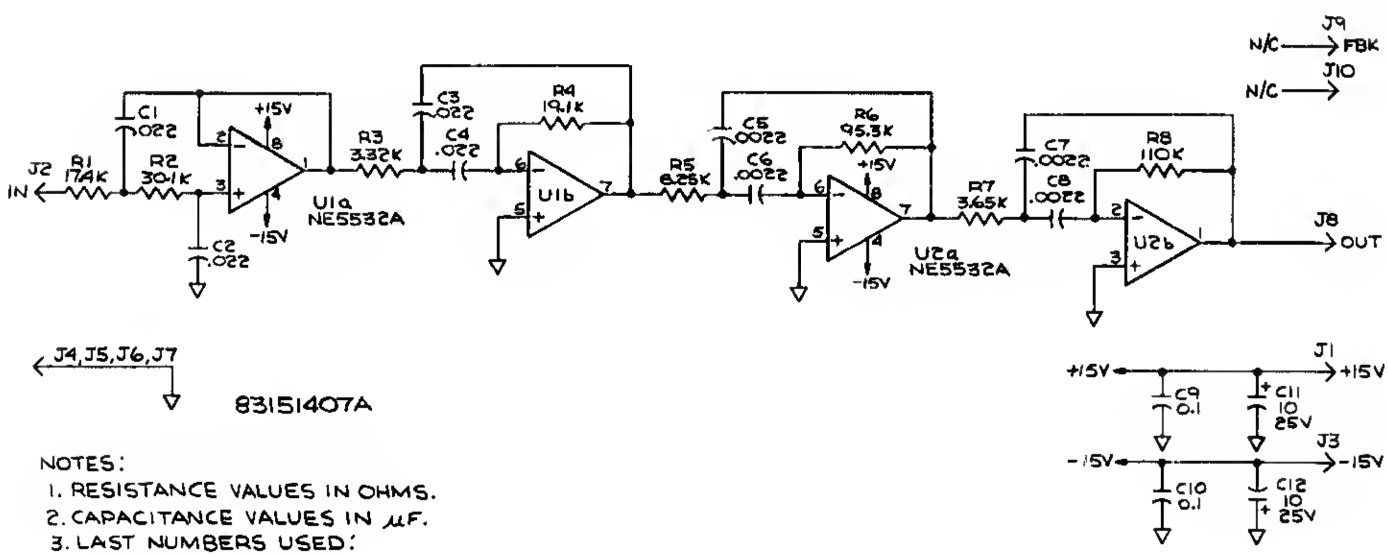
83151408B

Figure 7-40. AUDIO Board A1A37 Schematic



112070A

Figure 7-41. C-MESSAGE Board A1A38 Parts Location Diagram



83151407A

NOTES:
1. RESISTANCE VALUES IN OHMS.
2. CAPACITANCE VALUES IN μF.
3. LAST NUMBERS USED:
R8 C12

Figure 7-42. C-MESSAGE Board A1A38 Schematic